PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

PMM

DESIGN • MANUFACTURE • FINISHING • USE

...Highlight your product appeal

These new low cost Velvaglaze Finishes capture the gleaming brightness that highlights product appeal. They offer greater surface durability and resistance to scratching, discoloration and stain.

Many unusual finish designs are available through Monarch's exclusive Velvaglaze Process. These designs cut casting costs by eliminating multiple finishing operations. They reduce rejects now encountered on highly polished, easy to mar surfaces.

Velvaglaze Finishes offer you an additional bonus when you specify Monarch aluminum Permanent Mold Castings and aluminum Diecastings. Consult with a Monarch engineer on all of your casting and finishing requirements. He will give you complete information on the specific Monarch service that meets your individual need.

*T. M. Reg. U. S. Pat. Off.

- Aluminum Permanent Mold
- Aluminum Die Castings
- Certified Zinc Die Castings
- Complete Product Assembly
- Every Modern Finishing Service

Detroit Ave. at W. 93rd St., Cleveland 2, Ohio

CASTING NEWS NOTES

THE IMPORTANCE OF FINISHING METHODS on all types of castings is constantly stressed by Precision Metal Molding Magazine. Other magazines devote themselves almost entirely to this important phase of manufacturing. Design engineers today have an unusual opportunity to express their personal preferences on finishing specifications.

* * *

PURCHASING AGENTS OFTEN find themselves piecing together a jig saw puzzle when they try to combine the best casting source and price with the most desirable finishing method, source and price. Too few casting sources offer a complete line of finishing operations. Experienced Purchasing Agents usually avoid the problems that arise when castings and finishing operations are ordered from separate sources.

* * *

PROGRESSIVE FOUNDRIES are aware of this situation. They continually strive to increase the scope of their services to meet the increased demand for completed parts—finished and ready for assembly. It is extremely important, however, to analyze how these extra operations are quoted and to insist upon a complete understanding on the standards involved before an order is placed.

* * *

FINISHING OPERATIONS are often hard to define and agree upon. Any foundry that represents their ability to provide finished castings at a quoted price should be able to submit a similar production job that involves the same specifications they are quoting on your job. A thorough discussion, utilizing similar samples, can often uncover discrepancies in an original quotation. Better still, it may lead to an intelligent analysis of your requirements, indicating that a less critical standard could be used at a lower casting price.

* * *

MONARCH HAS SPECIALIZED in finishing aluminum Permanent Mold and Diecastings and Zinc Diecastings for many years. From our experience has emerged our increasingly popular VELVAGLAZE process. Many new innovations in VELVAGLAZE and other standard finishes are still ahead. Monarch is prepared at all times to show you what we can provide—we insist upon a clear understanding on the standards we are to produce on every order. Make this a habit when you order finished castings. MONARCH ALUMINUM MFG. COMPANY, DETROIT AVENUE AT WEST 93rd STREET, CLEVELAND 2, OHIO.

For additional information Circle No. 18 on the Reader Service Card

Leading manufacturers have learned to call on ADVANCE TOOL & DIE CO. of Milwaukee to handle intricate castings of every type. For instance—jobs like the multiple deep-finned engine housing above. With such exacting work, it's tough to keep costs down, and quality up. That's why ADVANCE uses precision-built CAST-MASTER machines. Like dozens of other leading shops, Advance has learned through experience that Cast-Master's speed and accuracy can make the difference between profit and loss on the "tough ones."

MAIL THIS COUPON TODAY!

Gentlemen:
Please send the newest CAST-MASTER catalog.

Name_____

Title_____

Company_____

Address_____

City_____ State_____

CAST-MASTER INC., 2123 Hamilton Ave., Cleveland 14, O.

CAST-MASTER *Inc.* **2123 HAMILTON AVE. CLEVELAND 14, OHIO**

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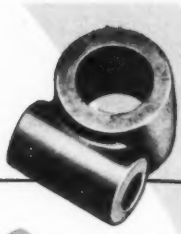
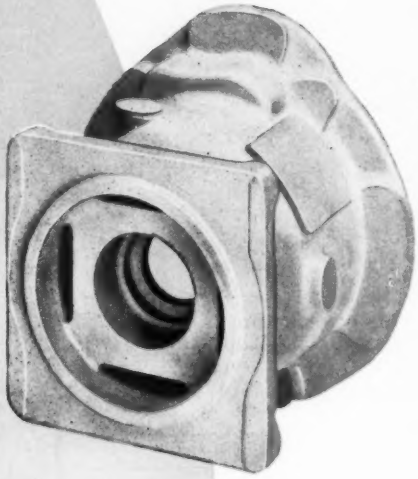


3 Steps to... COST SAVINGS with PERMITE ALUMINUM CASTINGS



1 Check over those component parts used in your assembly process which might give you a lighter, more efficient, better looking product, or bring you savings in production if cast from light-weight aluminum.

2 Draw upon the experience of Permite engineers who have helped manufacturers in widely varied fields design new parts or redesign old parts to gain full use of the many advantages of aluminum castings. Send us specifications or blueprints covering your parts requirements.

3 Study the recommendations and cost estimates which we will send you to decide whether it might not pay you in production savings and a better or more saleable product to change to Permite aluminum castings — permanent mold, semi-permanent mold or sand mold.

Why not investigate now? There is no obligation.

ALUMINUM INDUSTRIES, INC.

CINCINNATI 25, OHIO

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PERMITE Aluminum Castings

ALUMINUM PERMANENT MOLD and SAND CASTINGS . . . HARDENED, GROUND and FORGED STEEL PARTS

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DECEMBER 1952
Vol. 10 No. 12

PRECISION METAL MOLDING

DIE CASTINGS • INVESTMENT CASTINGS • POWDER METALLURGY
PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS

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Published monthly by the TECHNICAL PUBLISHING COMPANY, an affiliate of INDUSTRIAL PUBLISHING COMPANY, publishers of APPLIED HYDRAULICS, FLOW, INDUSTRY & WELDING, OCCUPATIONAL HAZARDS, COMMERCIAL REFRIGERATION AND AIR CONDITIONING. Member Controlled Circulation Audit, Inc. Not responsible for unsolicited editorial material. Indexed regularly by Engineering Index, Inc.

Subscription rates: United States and possessions—$3.00 per year; $5.00 for 2 years; Canada—$4.00 per year, $6.00 for 2 years; Foreign—$5.00 per year. Subscriptions in the United Kingdom £1.10 per annum, payable in Sterling to our London office. Single copy price 30 cents. All subscriptions subject to individual acceptance by the publisher.

Published monthly. Acceptance under Section 34.64 P. L. & R. authorized at Marion, Indiana.

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GOOD FRIENDS
GOOD LUCK

NEWTON NEW HAVEN

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LETTERS TO THE EDITOR

BRASS DIE CASTINGS

Kindly forward attached prints to firms equipped and experienced in brass die casting, for die quotations, price for 1000-3000-5000 pieces and delivery date. Moulders we have contacted specialize in white metal only. L. E. O.

There are only a few die casters set up to produce die castings in brass. Prints have been forwarded as requested. — Ed.

COVERAGE APPRECIATED

At the last meeting of the Executive Board of the American Electroplaters' Society, the excellent coverage of the metal Finishing Exposition and the Chicago Convention of the Society by PRECISION METAL MOLDING was commented upon and the writer was instructed to tender the appreciation of the Board and the Society to you for your heartening cooperation in helping to make both a success. Such efforts make it easier for us to better serve the metal finishing industry. — D. Gardner Foulke, Executive Secretary, American Electroplaters' Society.

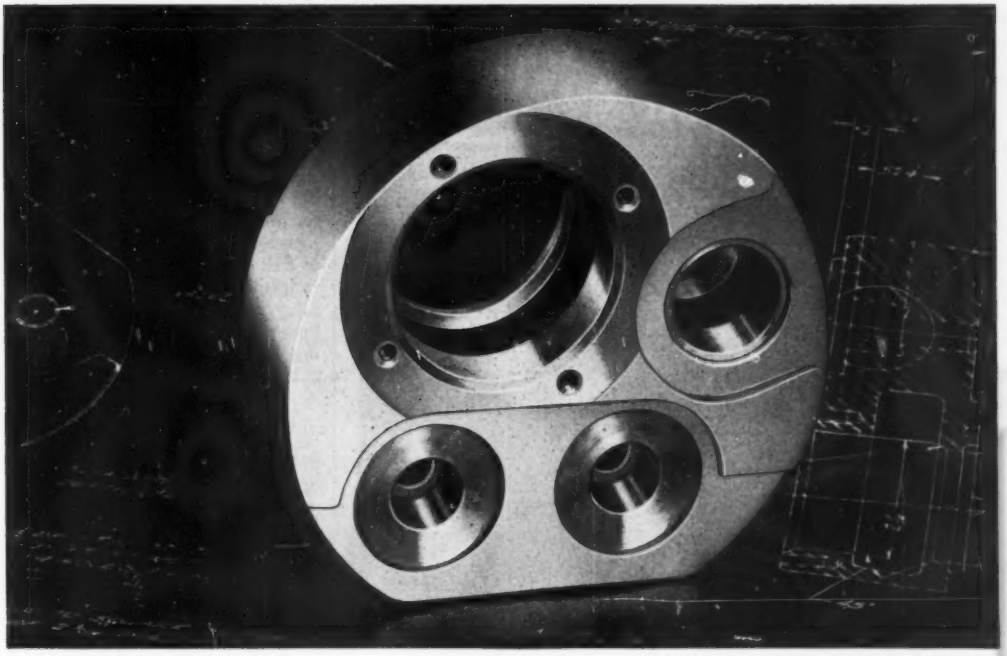
The editors of PMM have found that the AES convention and Metal Finishing Exposition are major events in the year's calender and should not be missed by anyone concerned with finishing metal products. The majority of PMM readers have a direct interest in one or more phases of metal finishing, and hence we feel that coverage of these events is a service to our readers. — Ed.

TIN ALLOY DIE CASTING

At the present time I am engaged in a project dealing with the fabrication of coffee perco-

continued on page 6

Only *MERCASTING** can make this as a unit!



*FROZEN MERCURY INVESTMENT CASTING

PROBLEM:

Three expensive machined parts were formerly required to get the necessary internal cavities for this valve body. Use on an electronic tube evacuator made special tolerances necessary. After assembly by welding, re-machining, and testing, a large part of the total production was rejected for failure to meet the rigid specifications of the manufacturer—Distillation Products Industries, Division of Eastman Kodak Company, well-known producer of high-vacuum equipment.

SOLUTION:

DPI brought the problem to Alloy Precision Castings Company. Cooperating Alloy foundry engineers and metallurgists developed the pictured one-piece, 5½-lb. mercasting of 303 stainless. The "as-cast" piece can be held to an average plus or minus .003 inch per inch on certain critical dimensions. A comparatively small amount of finish machining is needed on valve seats and tapped holes.

A-6750

SUMMARY:

The illustrated mercasting is a better valve body easily produced in a more desirable material. Tremendous savings are effected through elimination or drastic reduction of special tooling, machining, waste material, and scrapped production.

Send prints of your problem parts today. Learn how Alloy Precision can save you time and money.

ALLOY PRECISION CASTINGS COMPANY, DEPT. B-5
45th and Hamilton, Cleveland 14, Ohio

Please RUSH Bulletin 706 describing the Mercasting Process.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____

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ALLOY PRECISION *Castings Company*

EAST 45th ST AND HAMILTON AVE • CLEVELAND 14, OHIO

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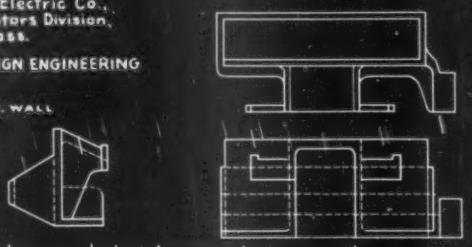
WANTED: closer tolerances reduced costs

SUGGESTED - BRUSH HOLDER

General Electric Co.,
Small Motors Division,
Lynn, Mass.

ATT: DESIGN ENGINEERING

.076 MIN. WALL



This design is the best from production standpoint
We could produce it to reflect credit
on both companies. E.B. Atlantic Casting

The production of a light weight, rugged brush holder for use with aircraft generators posed a problem for General Electric. They wanted a high-quality, rigid brush holder at reduced cost, produced by a process that afforded closer control of tolerances.

Atlantic was consulted and the recommendations they made on the brush holder design provided more than ample strength. The Atlantalloy process provided the close tolerances and lower cost.

Old brush holder designed by General Electric for use on aircraft generators.

New brush holder designed in collaboration with Atlantic engineers and produced by the Plaster Mold Process.

WRITE for a copy of "Quality Precision Castings for Industry" on your Company letterhead. This booklet explains how the plaster mold process cuts production costs, and includes specifications on Atlantic's alloys.

ATLANTIC
CASTING and ENGINEERING CORP.

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LETTERS TO THE EDITOR
continued from page 4

lators. It has been decided to utilize a tin or lead base alloy to join together various components of this assembly. The requirements of the bond include: non-toxicity in hot coffee and ability to withstand temperatures in the neighborhood of 212°F without undue change in dimension. In addition this alloy must be adaptable to low pressure die casting with a casting temperature in the neighborhood of 720°F or less.

— D. E. J.

Three tin base alloys that can be die cast satisfactorily at low pressure and temperature have been suggested. These alloys are most commonly used in soda fountain equipment, milking machines and similar applications where corrosion resistance is important and where the relatively low mechanical properties are not objectionable. One outstanding characteristic of the tin base die casting alloys is the low coefficient of expansion which is the reason they are widely used for small pinions in automatic voting machines that are exposed to broad ranges of temperature. —Ed.

"SINTERINGS" APPROVED

Your November 1952 issue of "Precision Metal Molding" suggests a new Nomenclature for Powdered Metal Parts to be described as "Sinterings".

As manufacturers of Powdered Metal Parts, we are of the opinion the word "Sinterings" is an apt description of our process and it would be somewhat difficult to find a more appropriate phrasing of Powdered Metal Parts.

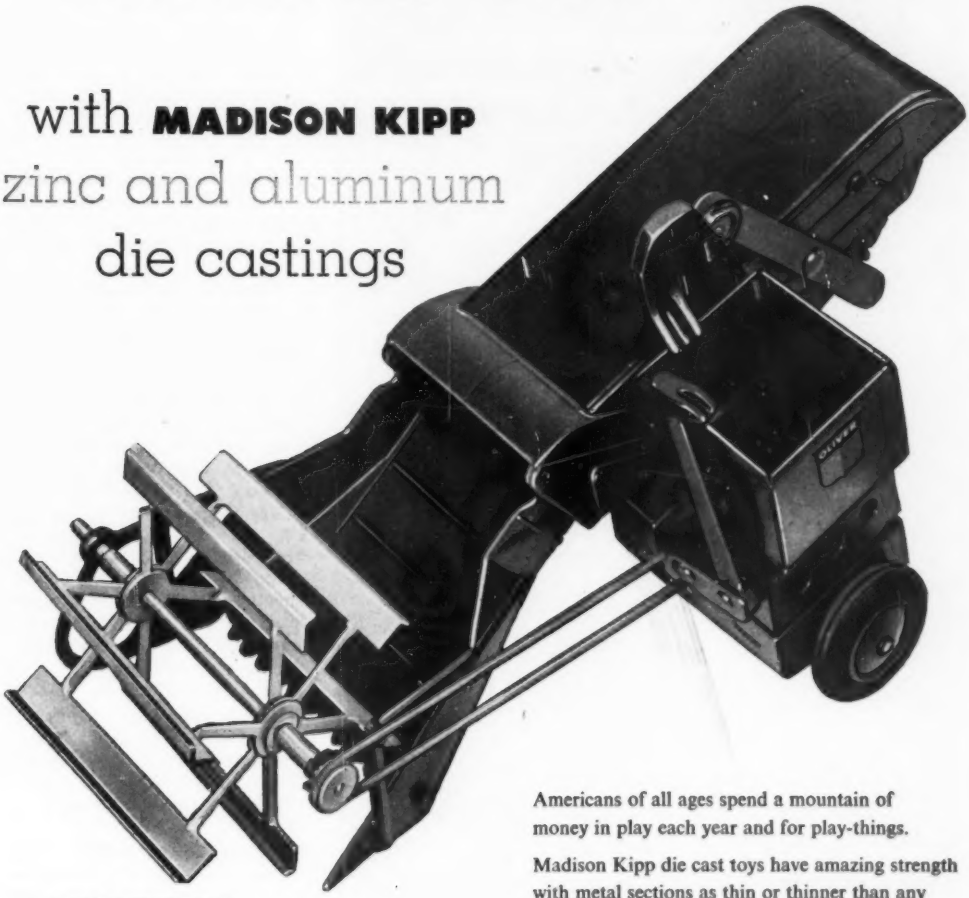
We are for it 100% and believe you will find the majority of Powdered Metal Fabricators will approve it also. — D. B. L.

So far, there have been no objections to the use of the word "sinterings" to describe parts

continued on page 8

DESIGNING for "fun"

with **MADISON KIPP** zinc and aluminum die castings



Kipp die castings made for Lansing Company Incorporated, Lansing, Iowa

Americans of all ages spend a mountain of money in play each year and for play-things.

Madison Kipp die cast toys have amazing strength with metal sections as thin or thinner than any other castings produced out of aluminum.

Designers of other commercial and ordnance products may find helpful hints from the engineers who design for the fun business.

Please send your inquiries to our home office in Madison, Wisconsin.

madison kipp corporation

MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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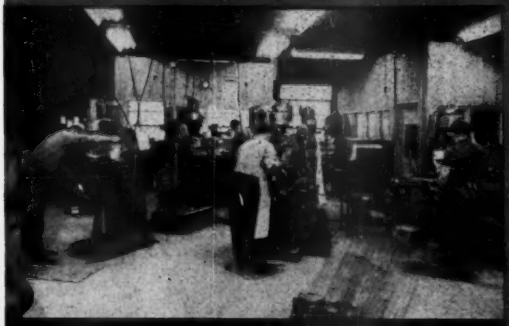
We Have the "Know-How"

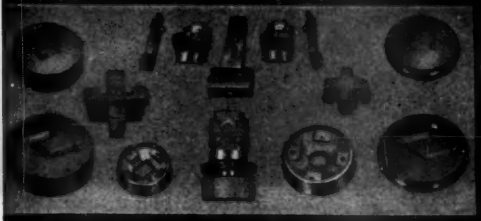
• the Men of Experience
• the Quality Machines

for the Production of



DIES LIKE THESE

Staffed by specialists with many years of experience PMD is ready and equipped to meet your exacting specifications for highest quality and most intricate dies.



PMD

PERMANENT MOLDS AND CORES • TUBULAR DIES
EXTRUSION DIES • DIE CASTING DIES

Serving Industry Throughout the United States and Canada. PMD Customers Include: Major Manufacturers in the Aluminum, Appliance and Automotive Industries.

A COMPLETE DIE DESIGN SERVICE AVAILABLE

PERMANENT MOLD DIE COMPANY, INC.

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LETTERS TO THE EDITOR
continued from page 6

fabricated from metal powders. We believe, along with the Nomenclature Sub-committee of ASTM, that the words, "powdered metal parts" are clumsy and inaccurate in connotation.
— Ed.

CHROMATE SURFACE TREATMENT

I note in the October issue the first article of a paper on "Chromate surface treatment for Precision Molded Aluminum".

I am anxious to see the second part of this paper, which I note is to appear in the November issue, as we use a great deal of aluminum tubing and castings in the fabrication of prosthetic appliances and I think perhaps this surface treatment may apply to our use of these materials. — H. C. F.

Copy forwarded. — *Ed.*

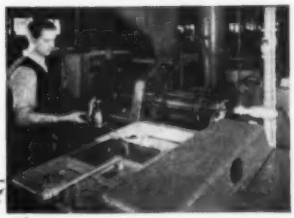
TEAR SHEETS REQUESTED

May we have a set of tear sheets of the article "Characteristics of Nickel-Cadmium Batteries by Powder Metallurgy" which appeared on page 49 of your August issue? — C. K. B.

Kindly send me a reprint of the article, "Vacuum Metallizing Produces Bright Metallic Finish on Die Castings," by R. W. Brown, October issue.
— M. J. Y.

Kindly forward three tearsheets of article entitled: Beryllium Copper Cavities for Die Castings, as it appeared in the August 1952 issue, page 32.
— R. I. P.

The number of requests for sheets and reprints has increased greatly during the past year. We are only too glad to supply tear sheets as long as our supply holds out. In this connection, readers may wish to glance through the annual index of subject matter appearing in this issue. There may be articles which you have missed earlier in the year or on which you wish an extra tear sheet for your files. — *Ed.*



LINDBERG IN England

Manufactured by the Electric Furnace Company, Ltd., these two-chamber Lindberg-Fisher melting furnaces are installed in the Newcastle-under-Lyme works of the British Thomson Houston Co.

This installation is typical of many others throughout the world where Lindberg-Fisher melting furnaces . . . utilizing the famous two-chamber principle . . . are minimizing metal impurities, reducing metal losses, speeding production and cutting costs.

Lindberg-Fisher melting furnaces will solve die casting production problems . . . for details and "case history" information contact your nearest Lindberg-Fisher representative.

LINDBERG-Fisher MELTING FURNACES

LINDBERG ENGINEERING COMPANY,
2463 West Hubbard Street, Chicago 12, Illinois

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Action with Accuracy!

--From Start to Finish

Our Facilities Are Complete For

ZINC - ALUMINUM - LEAD DIE CASTING

Here—at ***FORT DIE CASTING,*** production of quality die castings, at lowest cost, is made possible through the completeness of our organization and superb equipment, in our fully modern 100,000 square foot plant.

ENGINEERING: We maintain a competent Engineering Department to assure good casting design, the proper types of metals and methods to be used, and for close co-operation with our clients.

TOOL and DIE: We maintain complete tool and die making facilities. In this department, staffed by skilled technicians, we are equipped to completely tool up for your program and manufacture the dies to meet your specifications.

DIE CASTING: We maintain large batteries of modern die casting machines to meet all size requirements, plus special machines for die casting aluminum and lead. Expert metallurgical control is assured for the proper choice of alloys.

MACHINING: We maintain an unusually complete Machining Department. For these important and cost-saving operations, we design and manufacture new labor-saving jigs and fixtures for use in our large batteries of presses and other machining equipment, and when necessary, we design and build special purpose machines.

PLATING and FINISHING: We maintain complete facilities for mechanical finishes such as, burnishing, buffing and polishing; plating and finishing processes such as, chemical treatments, electrolytic coatings and painting.

Yes—you'll get ***Action*** with ***Accuracy,*** from ***Start*** to ***Finish*** at ***FORT***—and insure the proper and most economical production for your die cast products. We invite your inquiries.

TRADE FORT MARK

FORT DIE CASTING CORP.

MARYSVILLE, MICHIGAN

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Between The Lines

in this and coming issues of PMM

• LITTLE KNOWN or appreciated are the many ways in which the peroxygen compounds can be used for surface treatment of both ferrous and non-ferrous metals. A review of these treatments is discussed beginning on page 53.

• NEW MATERIALS or processes are rarely accepted without careful consideration and testing. How one manufacturer of business machines has gone about the job of introducing sinterirngs in place of punch press and screw machine parts is related beginning on page 42.

• FROM INITIAL CONCEPT through final inspection, two investment castings are traced in Part 2 of an article on aircraft structural investment castings beginning on page 29.

• IS ELECTROFORMING suited to produce metal parts in production quantities? A thorough article on this unique process, its characteristics and potential applications begins on page 45.

• PRESSES FOR POWDER METALLURGY will be reviewed in a comprehensive report offered by PMM in January. A full tabulation of available presses with specs of each, plus a summary of the general characteristics of presses, will be a valuable reference piece.

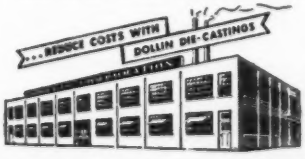
• TWO COMPLETELY DIFFERENT applications of die castings in the manufacture of instruments can be compared in a pair of articles in this issue. A comparison of die cast and stamped mounting panels for electronic instruments begins on page 32, while the use of die cast cams and other small mechanical parts is reported beginning on page 34.

DOLLIN ZINC and ALUMINUM DIE-CASTINGS

Specified by many leading manufacturers

for high quality at low cost

Dollin's specialized equipment cuts costs through all commercial sizes. For example, *high speed* production of small zinc castings (1000 per lb. to 3 per lb.) is available on *fully-automatic* machines in our *Small Castings Department*. Small Parts Bulletin and samples, General Bulletin available on request.



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614 So. 21st St.
Irvington 11, N. J.

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i wrote to the boss

Dear Boss:

I need a new die casting machine
One with dies so smooth and clean
That castings eject without a jerk
Then I can do a full day's work.

Dies that do not wheeze and smoke
So that each cycle makes me choke
That make each casting sharp and fine
Without parts sticking all the time.

Give me this, and then dear Boss,
I'll not be working at a loss!

joe

and his solution

Dear Joe:

When you began on that machine
It *was* brand new and mighty clean.
You never failed to make your quota
With rejects less than one iota.

But homemade greases for the dies
Got more than smoke into your eyes.
Your parts per hour will run too few
When half the time you choke and stew.

We need not buy a new machine
And sure can make these dies come clean
By getting Die Slick of proper grade
Use it and watch your trouble fade.

the boss

is now my new year's resolution

I now use Die Slick all the time
And my castings are clean and fine
I'll shout to all casters loud and clear
Merry Christmas, Happy New Year.

DIE SLICK

the industry's standard die lubricant

. . . and if you want happier days in your plant, then do as 78% of all die casters have done and standardize on DIE SLICK AND PLUNGER SLICK . . . the best die casting die lubricants that money can buy!

G. W. SMITH & SONS INC. • 5403 KEMP ROAD • DAYTON, OHIO

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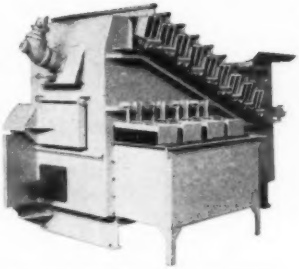
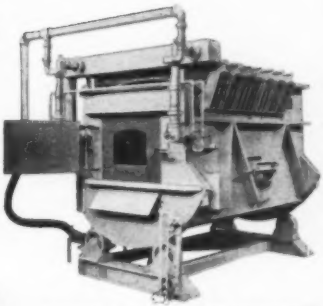
ALUMINUM

These Stroman Built Furnaces are designed for production of unsurpassed quality metal in the fastest, most efficient and economical manner. Built for all purposes and capacities they meet the demands of the sand foundries, die casters, permanent mold plants and smelters. They are recognized as the finest in the industry and reduce costs and make working conditions most agreeable. All furnaces may be fired by oil or gas.



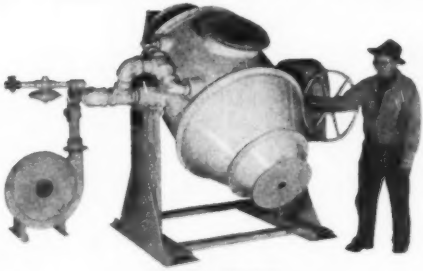
MODEL "MC" DIP-OUT TYPE

For melting and holding all in the same furnace. Hot metal always available. No iron pots or crucibles to replace. Capacities from 500 to 5000 pounds aluminum.



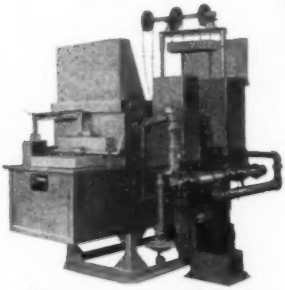
MODEL "SW"—TILTING TYPE

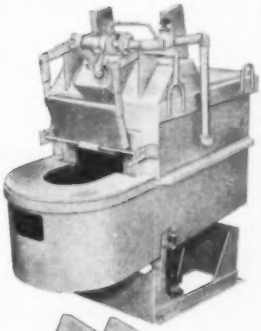
Excellent to run back returns along with ingot required for permanent mold, die or sand casting operations. Also an ideal breakdown furnace. Capacities—600-1000-1700-3000 lbs. Aluminum.

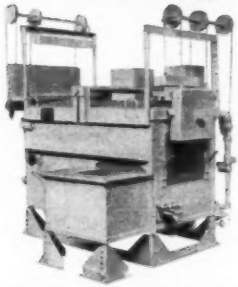


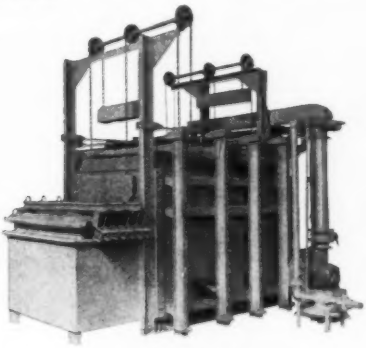
MODEL "BFC"

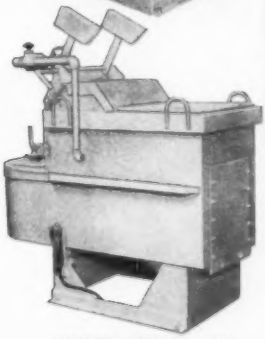
Hand tilt, open flame, barrel type furnace with flames firing tangent to inside of lining. Very fast melting. Used in all type plants including smelters. Capacities—500 lbs. Aluminum. A must for all aluminum jobbing sand foundries.











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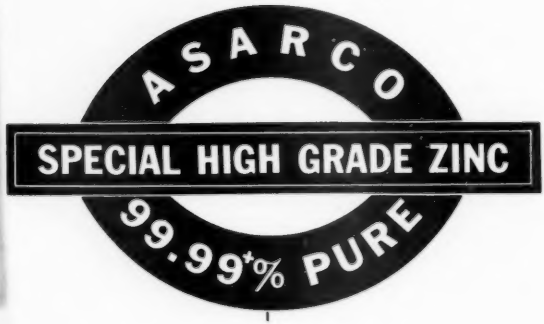

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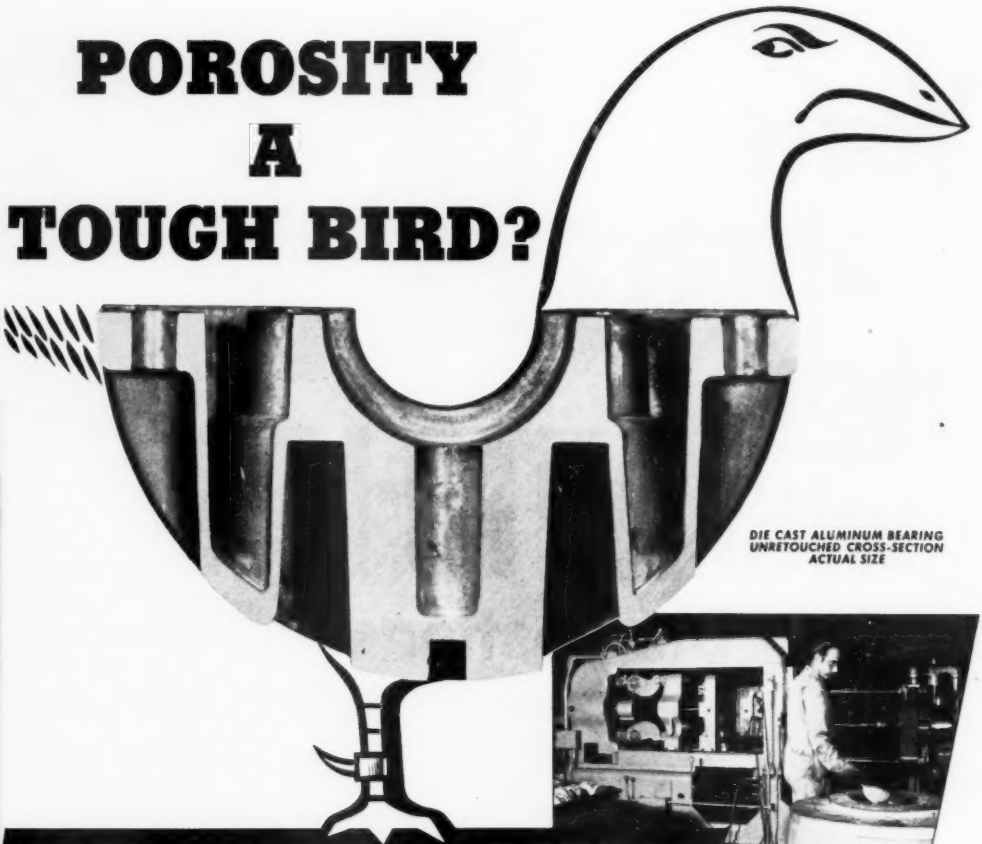

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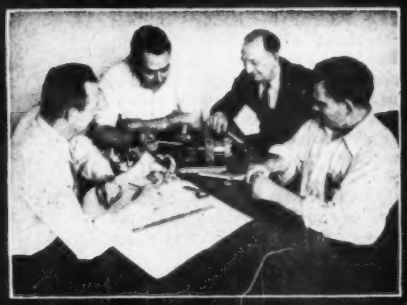

Why? One good reason is Bill Brown, our plant manager, a veteran of more than thirty years in the die casting industry.

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2 ZINC, the Metal...

number 3 of a series

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THE emergence of die casting as the country's largest consumer of Special High Grade Zinc is a success story which was "plotted" in the laboratories of Bunker Hill. It was here that in 1928 the production of four-nines zinc was first developed from the status of a laboratory phenomenon into a commercial reality by introducing Bunker Hill 99.99+% Zinc into the market.

In view of its present rank as a consumer of zinc, it is interesting to note that up until 1925, the American Bureau of Metal Statistics and the U.S. Bureau of Mines reported the tonnages of zinc used in die casting alloys under the heading of "other uses." In 1926, the first year that the industry was accorded the distinction of a separate classification as a zinc consuming industry, only 4% of all the zinc consumed in the United States was used in die casting alloys. This was due to the fact that die castings, based on the grades of zinc then available, were restricted in their applications on account of limitations in physical properties. With the advent of Bunker Hill 99.99+% Zinc, and with practically no change in the existing alloys but the substitution of "four-nines" for "three-nines" zinc as a base, the use of zinc alloy castings increased enormously. Currently, the die casting industry accounts for about 30% of the country's total annual zinc consumption.

Bunker Hill Zinc runs consistently 99.99+%– it was the purest zinc available in 1928, and remains so to this day.

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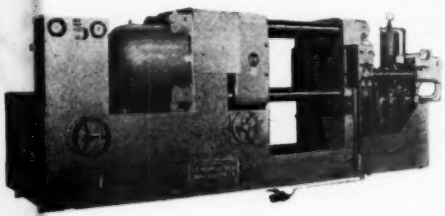

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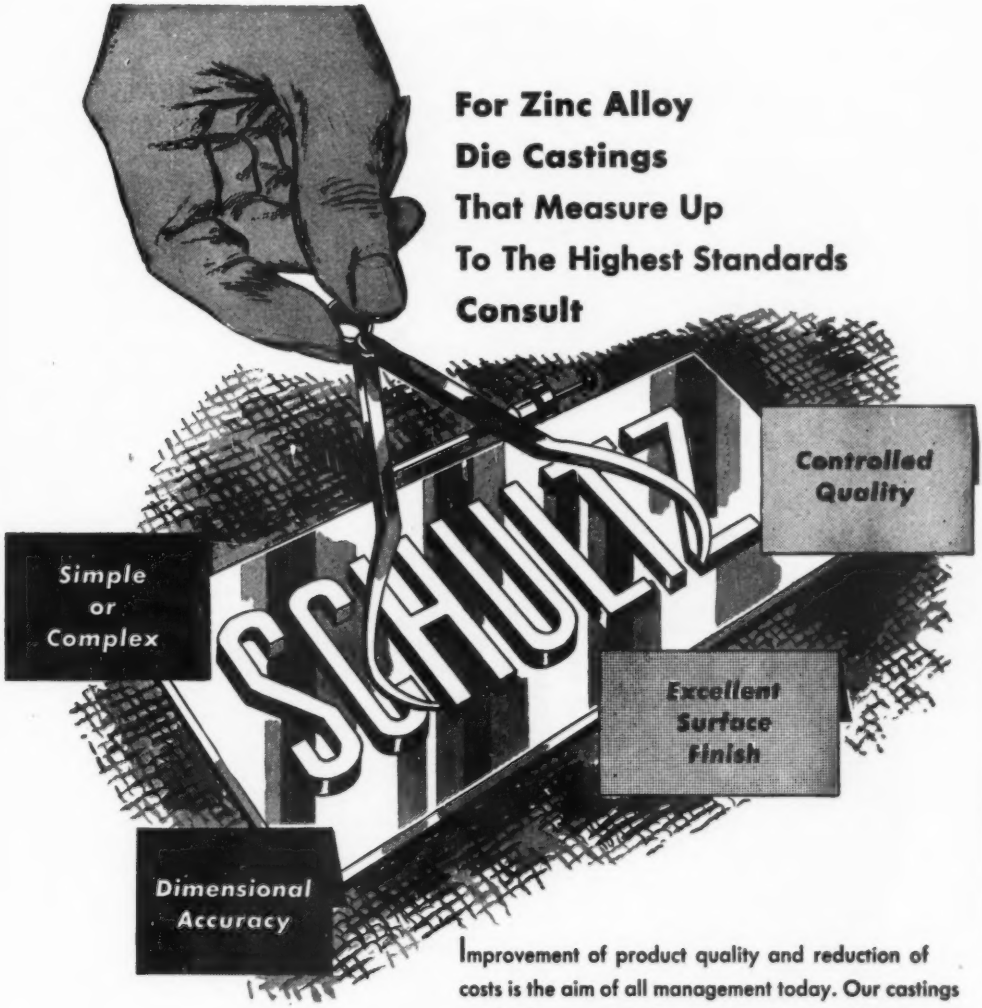

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Improvement of product quality and reduction of costs is the aim of all management today. Our castings are both competitively priced and outstanding in quality, and can help you build a better product for less. May we quote on your requirements today?

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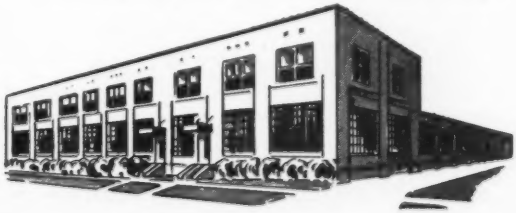

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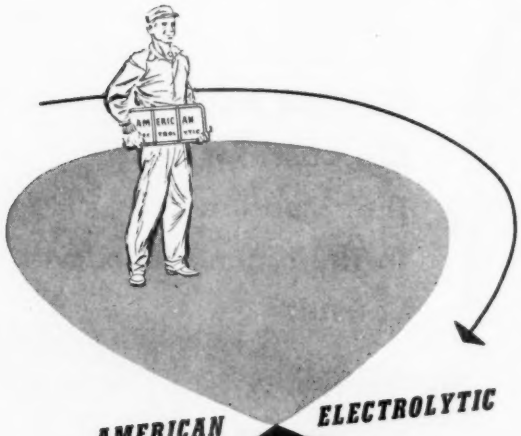

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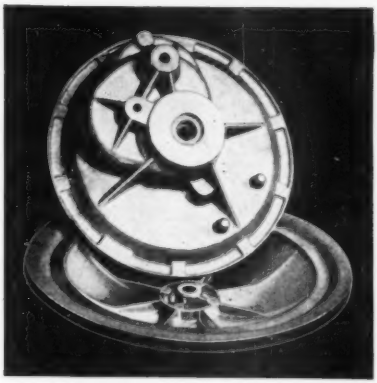

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Pydraul F-9 is Monsanto's nonflammable-type hydraulic fluid. Under test conditions, it does not flash or ignite when sprayed, dripped or flooded on molten metal heated to approximately 1,500° F., nor does it ignite or flash when sprayed, at 1,000 p.s.i., into the 6,000° zone of an oxyacetylene flame. Users say Pydraul F-9 has prevented fires in their plants.

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Investigate the increased safety, efficiency and economy of Monsanto Pydraul F-9 today. Contact the nearest Monsanto Sales Office or write for a copy of the 12-page, file-size booklet, "Pydraul F-9." MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

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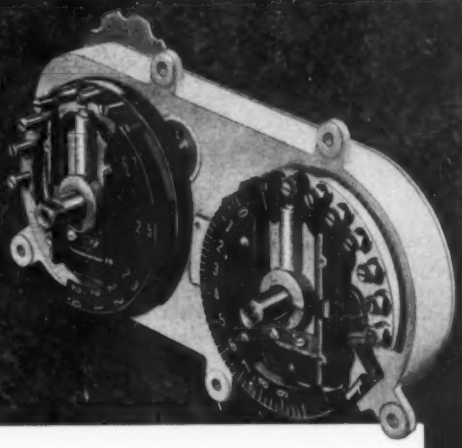


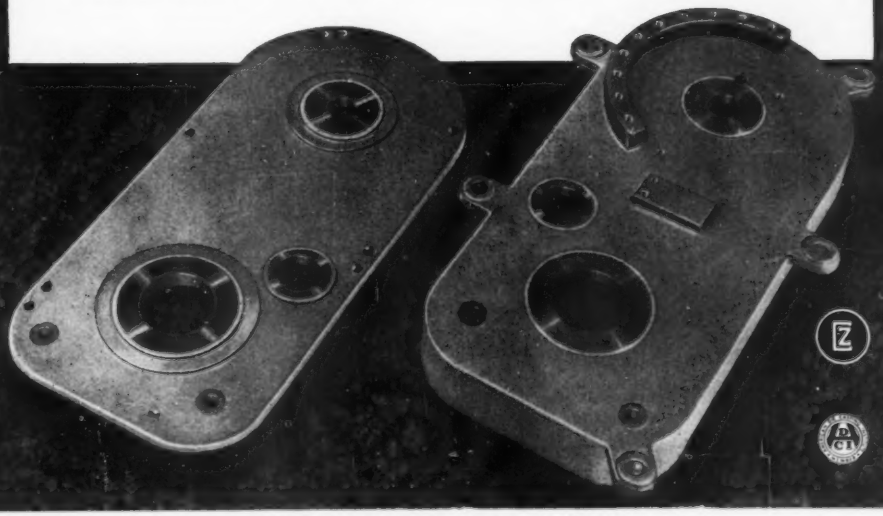
CASE HISTORIES FROM MT. VERNON FILES

Fast production with *economy*—that's die casting's supremely important contribution to the needs of today. For die casting is industry's versatile top-speed, money-saving production tool.

Take, for example, the Lewyt Corporation. Even as vacuum cleaners march steadily along its production lines, a division of the plant is being devoted to manufacture of components for military radio transmitter-receiver sets.

Shown here, is a Lewyt-made, panel-mounted dial drive assembly. The gear train housing, produced by Mount Vernon, is cast in two matching halves, *complete with bushings and all details as specified.* With a minimum of machining, a tight fit of the two portions is obtained, and the housing is ready to receive the intricate gear assembly needed for coupling the megacycle and one-tenth megacycle controls, and other parts, to each other.

However complex or simple *your* product, and however critical the dimensional accuracy it demands, it is very probable you can produce it most profitably by Mount Vernon die casting. So send us your specifications. Our wealth of specialized knowledge is at your disposal, and we'll gladly make recommendations based on your particular needs.



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Cycling 700 shots per hour

WITH OIL TEMPERATURE NORMAL

"When you take into consideration the fact that this machine cycles up to 700 shots per hour, you will realize the necessity of adequate cooling of the hydraulic fluid", says B & T Engineering and Sales Co., manufacturer of high speed die casting machines.

...and *adequate cooling* means only one thing to this highly regarded Detroit company: ***heavy duty Ross Type BCF Exchangers***. They are standard specifications on all B-T machines. "We have found them to be the most efficient type of cooler we have been able to obtain."

Serving the hydraulic system of machines like these, which have a line pressure of 1000 psi, develop pressures up to 4000 psi on the metal injection, and exert a locking pressure of 450 tons, Ross Type BCF Exchangers have a heavy responsibility heaped upon them. Oil temperatures must *always* be right. Overheating and consequent oil-thinning cannot be tolerated. Pump slippage, robbing essential capacity, would result. But, the Ross Exchanger on this B-T machine, as on dozens of other makes, does the job it's called upon to perform. Temperatures are *kept* within recommended limits.

For information on the exchanger that machinery builders are proud to list as standard equipment, request Bulletin 1.1K5. It tells about the enduring copper and copper alloy construction, pre-engineering and standardization that have made Ross famous.

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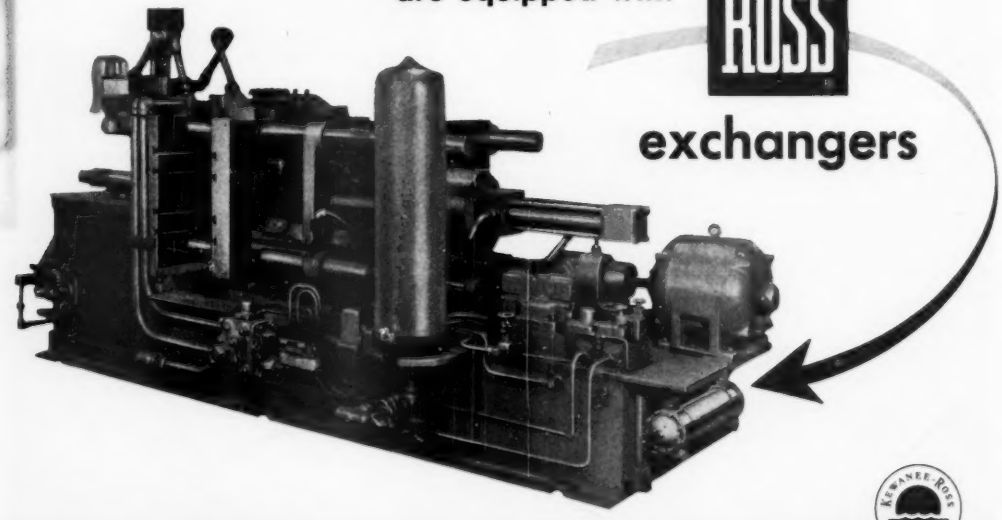
B-T Die Casting Machines are equipped with ROSS exchangers



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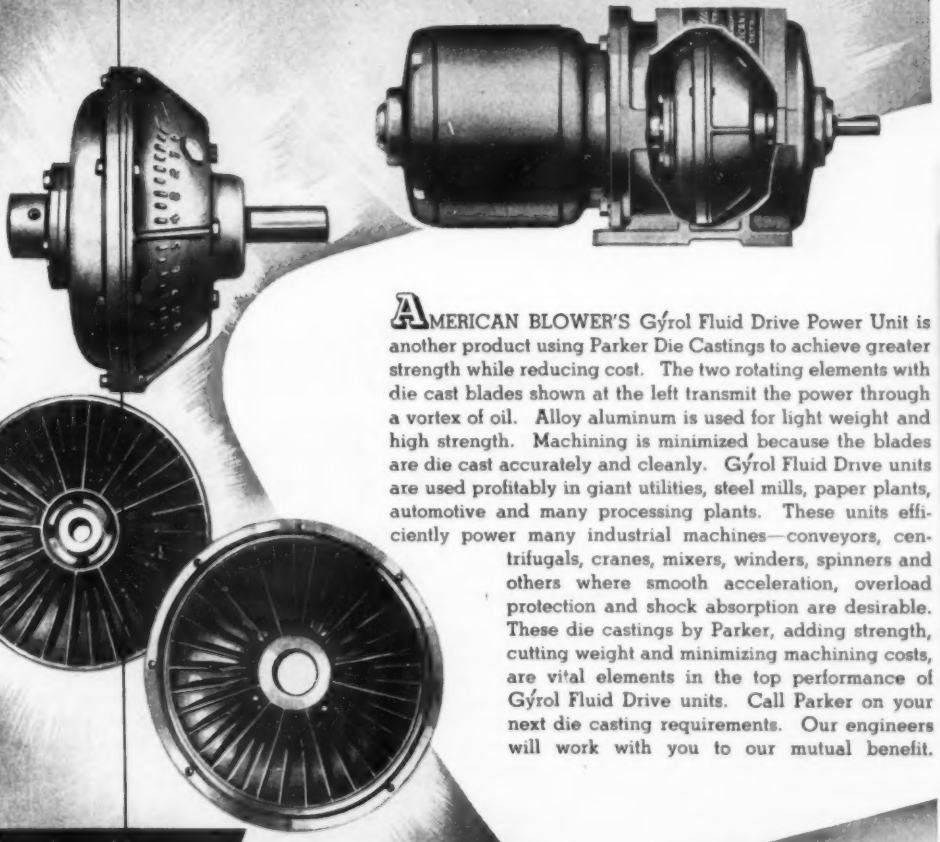
to Reduce **COST**, *Add Strength, Minimize Machining*



AMERICAN BLOWER'S Gyrol Fluid Drive Power Unit is another product using Parker Die Castings to achieve greater strength while reducing cost. The two rotating elements with die cast blades shown at the left transmit the power through a vortex of oil. Alloy aluminum is used for light weight and high strength. Machining is minimized because the blades are die cast accurately and cleanly. Gyrol Fluid Drive units are used profitably in giant utilities, steel mills, paper plants, automotive and many processing plants. These units efficiently power many industrial machines—conveyors, centrifugals, cranes, mixers, winders, spinners and others where smooth acceleration, overload protection and shock absorption are desirable. These die castings by Parker, adding strength, cutting weight and minimizing machining costs, are vital elements in the top performance of Gyrol Fluid Drive units. Call Parker on your next die casting requirements. Our engineers will work with you to our mutual benefit.

and when you think of Die Castings **THINK OF**

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PARKER ALUMINUM *and* ZINC *Die Castings*

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To those interested in cutting production costs

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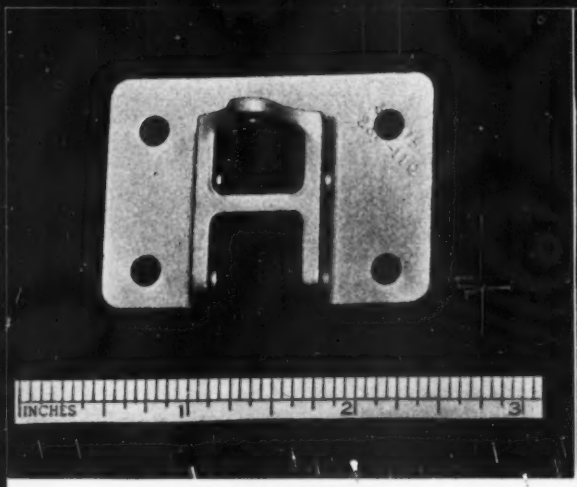


LATCH HOUSING

BELLCRANK

Use of INVESTMENT CASTINGS in aircraft structural parts - Part 2

By
ARTHUR C. WILLIAMS
Special Products Div.
Crucible Steel Company of America

assisted by
JOSEPH H. MASSA
Standards & Materials Dept,
Republican Aviation Corp.

(Editor's Note: Part 1 of this article which appeared in the November issue of PMM contained background information on the use of investment castings for aircraft structural parts. Included were discussions of tolerances, casting hazards considered, comparison of mechanical properties of investment cast and wrought materials, and basic considerations in specifying.)

HOW investment castings are successfully applied to aircraft structural part designs may be best described by an actual case history of two component parts, tracing them step-by-step from design through to the finished casting, ready for assembly. On the following pages are listed the steps in planning, producing and inspecting a latch housing investment casting and a bellcrank investment casting. The finished castings are shown above as completely machined and ready for assembly.

continued next page

LATCH HOUSING

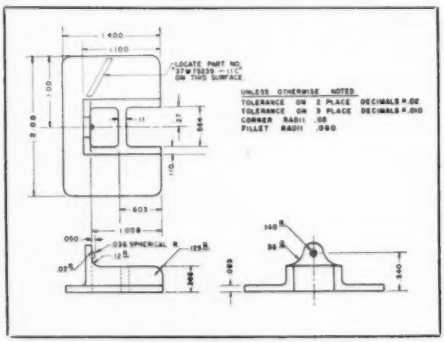
BELLCRANK

Step 1: The functional idea

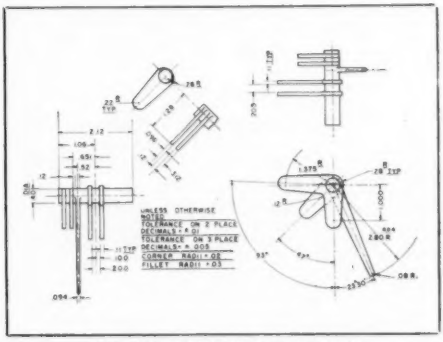
This unit is used as a housing for a small door latch. A small spherical node is required as an aligning stud for the latch closure spring. A rectangular inside opening is required and flat base all in thin wall high strength steel. An investment casting could eliminate all machining except the drilling of assembly holes and attaching holes. Further some protection against corrosion is required so a plating operation can be avoided by specifying a stainless steel for the casting.

A bellcrank is required as a releasing mechanism for both hand and electrical operation. The functioning of this apparatus requires a torque shaft to which several levers are integrally attached. These levers have to be properly spaced with various angular relationship to the axis of the shaft. This part would be very difficult and expensive to fabricate by any other means than a precision casting and still maintain integrity of design.

Step 2: Investment casting drawing taken from final design. If machining operations are required on the casting, a separate drawing must be made. On the other hand if the casting is required at high hardness which would make machining difficult, most investment casting producers will perform the machining operations required on the annealed casting before final heat treatment.



CASTING DRAWING: LATCH HOUSING



CASTING DRAWING: BELLCRANK

Step 3: Steel selected

Stainless Steel Type 316, annealed.

Mod. 4140 steel, Normalized and tempered.

Step 4: Mechanical properties

Tensile strength	65,000 psi min.
Yield strength	25,000 psi min.
Elongation	20% min.

Tensile strength	100/250,000 psi
Yield strength	55,000 psi min.
Elongation	8% min.

LATCH HOUSING

BELLCRANK

Step 5: Structural classification selected according to margin of safety in the part design. Castings having a margin of safety of less than 900 percent are classified as Class A. Castings having a margin safety of 900 percent and greater are classified as Class B. Classification determines the standards of acceptance of castings in radiographic inspection as explained in Step No. 14.

Class B

Class B

Step 6: Specification assigned

AMS 5361, except for physical properties as given in Step No. 4.

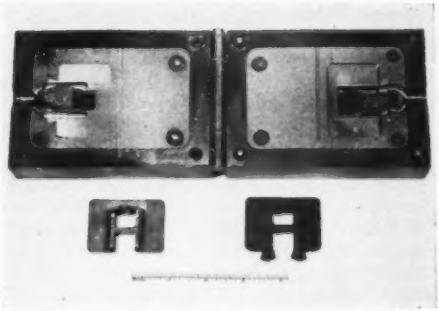
QQ-S-681 except chemical analysis shall conform to MOD 4140 steel, Spec. AN-QQ-S-752 and physical properties as given in Step No. 4

Step 7: Drawings with complete information contained in Steps No. 2 to No. 6 are submitted with inquiries to investment casting producers. Quotations of investment castings usually comprise casting price, tooling cost as a separate item, expected delivery of samples for approval, delivery of castings at required rate after approval of samples and estimated casting weight for allotment purposes.

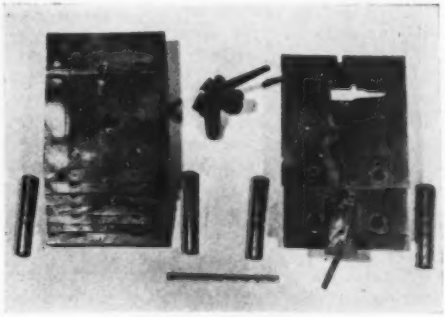
Step 8: Working casting drawings are prepared, if the contract is awarded to Crucible. Republic's drawings are made by designers and checked by engineers who are fully acquainted with the advantages and limitations of investment castings as described before. Hence, it is rarely necessary to take any exceptions to their drawings and the working casting drawings are a direct copy of the drawings shown in Step No. 2.

Step 9. Wax injection tooling drawing is prepared.

Step 10. Tooling is made.



TOOLING FOR LATCH HOUSING



TOOLING FOR BELLCRANK

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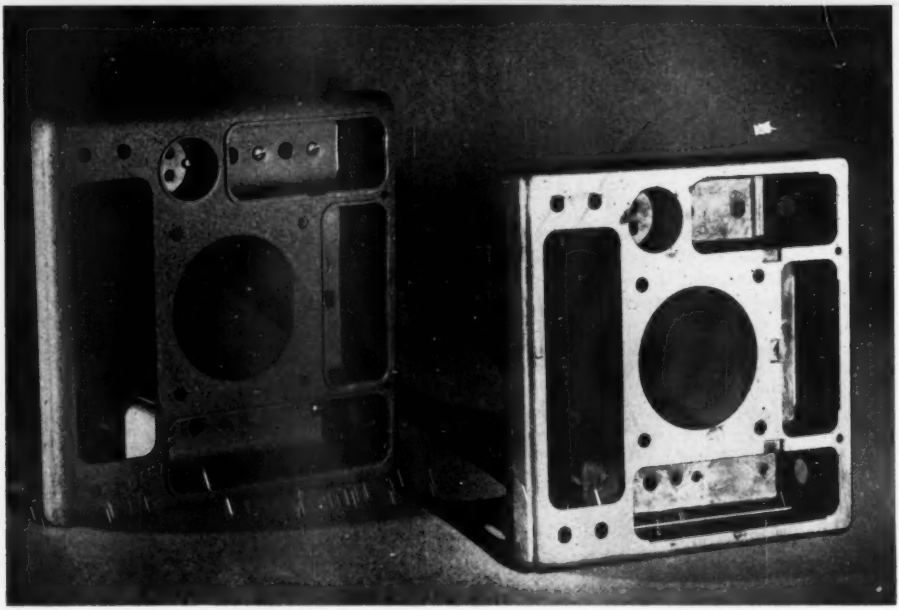


STAMPED DIE CAST

For panel-type assembly DIE CASTINGS replace stampings

By WALTER M. JONAS*

EXPERIENCE of Radio City Products Co., Inc., with both stamped and die cast mounting panels for electronic testing instruments has revealed some comparisons that should be of interest to designers working with panel-type assemblies.

These comparisons favor the die cast panel whether in terms of finished piece costs, number of in-plant operations, time and labor consumed, ease of finishing, structural strength, tool costs or inventory.

As an example, a stamped mounting panel and the die cast aluminum panel which has replaced it, are illustrated on these pages, with some specific manufacturing comparisons.

This is not to imply that die castings are a cure-all, or that these particular castings have been achieved without close cooperation and special effort between the die casting vendor and Radio City Products.

The fact is, the thin, uniform section (3/32") and deep cores, created a real problem in die-filling, but minor design changes such as the introduction of webs between the recessed chambers of the panel helped to solve the difficulty. The comparisons offered here are on the basis of current production experience, with all important die casting problems now solved, and normal shipments of castings being received regularly.

Also it is pertinent to point out here that since this equipment is produced for the military establishment, all tooling costs had to be amortized over the initial run. This naturally enters the calculations, even though subsequent orders have been produced from the same tools.

---

*Production Manager, Radio City Products Co., Inc., New York.

Unitary construction vs assembled stampings

Stamped panel: The stamped panel was supplied drawn, but without holes. Four rectangular holes were punched using an indexing fixture and punch press. A separate punching operation was required for the round holes. Each of four wells was drawn separately and mounted into the punched holes, attached by strip steel brackets and machine screws.

Die cast panel: The die cast aluminum panel is supplied as a one-piece unit having four wells and major holes formed by cores in the die casting die. Two sets of small holes are punched and small side holes for hinge screws are drilled. The top surface is touched to an abrasive belt to remove ejector marks and flash.

Costs in tooling, labor and time

Stamped panel: Stamping requires blanking, drawing and punching dies for the panel and four separate wells. Tool maintenance on this type of die is high. Eight brackets had to be cut from strip stock and drilled. Each panel and pocket was finished individually and assembled into the unit. Five stampings, eight brackets, eight screws and eight nuts were procured and inventoried for each panel.

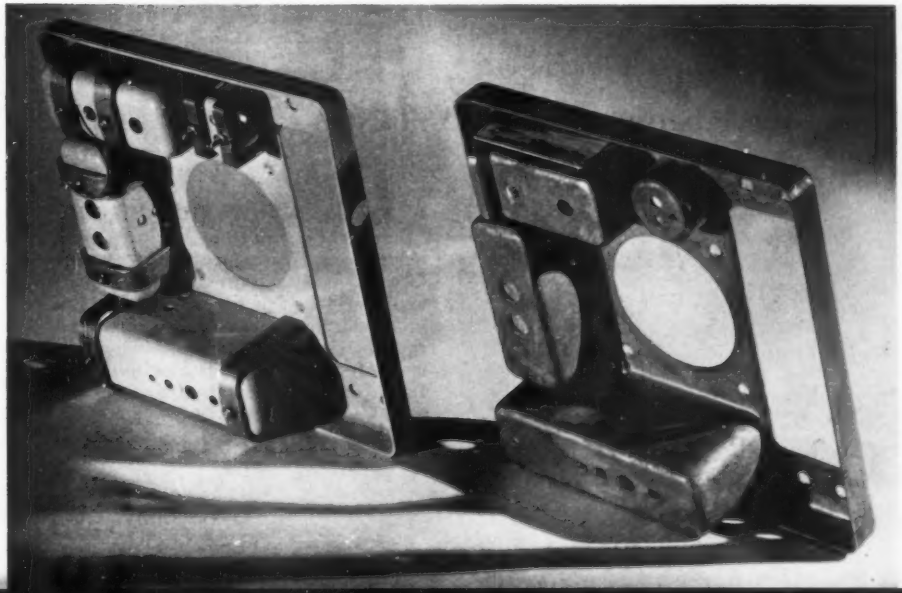
Die cast panel: A single-cavity die casting die, plus trim and punch dies for two sets of small holes, are required. No assembly of parts is required. The panel is ready without fitting, fastening, cutting of mounting strips, shaping or other in-plant operations. Twenty minutes of labor have been saved per piece. The die casting is paint sprayed in one operation, compared with five individual painting jobs on the stampings. Total piece costs, including tool amortization, have been cut more than 50 percent by die casting.

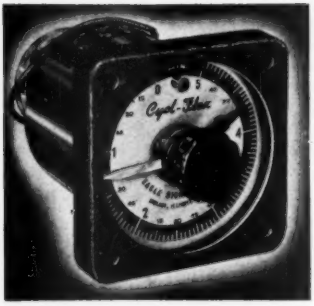
Improved structure and performance from die cast panel

Stamped panel: With large areas punched out, the stamped panel is weaker, less rigid than the die casting. A special problem was the grounding of the mounting brackets through the coat of paint on the panel. Special care had to be taken to see that the ends of the mounting brackets cut through the paint at the points of contact.

Die cast panel: Despite the limitation that all units, whether stamped or die cast must be interchangeable in the field, the die cast panel has certain improvements while maintaining strict dimensional uniformity. The one-piece construction is stiffer and stronger; there is no problem of grounding mounting brackets, since there are none; one pocket has been given a sloping wall to make a connector more accessible, a feature impossible to achieve in a stamping.

STAMPED DIE CAST





PRODUCTION PROBLEMS common to small instruments have been solved by the manufacturers of this industrial timer. Special attention has been been given to design of small cams, gears, spacers and links.

Small instrument parts designed as DIE CASTINGS and SINTERINGS

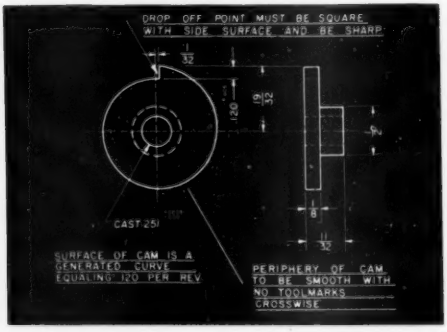
AN example of both redesign and careful original design for lowest cost manufacturing is shown in the several industrial timers made by the Eagle Signal Co. of Moline, Ill. The use of die castings and sinterings* to be described are typical of the possibilities of cost saving through the use of one or several PMM processes.

Disregarding, for the moment, housings and mounting members which are "naturals" for die casting, the principal applications for precision forming methods in the timer field are in gears, cams and linkage members. Within this group of parts, the several criteria that determine usefulness are accuracy of shape, wear resistance, adequate strength for the service conditions encountered and resistance to corrosion under a wide variety of ambient conditions.

A few of the die cast parts and some of the sinterings* currently being used by Eagle Signal Co. are shown in the following illustrations. All of the die castings are made by the Midwest Die Casting Co. of Milwaukee, Wisc., of zinc alloy, ASTM XXIII (SAE 903). The sinterings are made by the Chicago Powdered Metal Products Co. of Chicago, Ill., in the material designated for each.

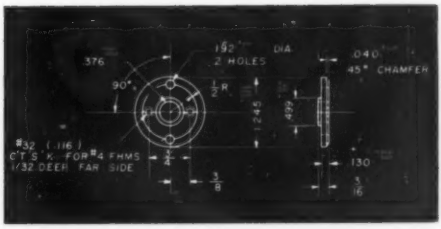
***"Sinterings" is now used to identify parts produced from metal powders.**

. . . these are better as DIE CASTINGS

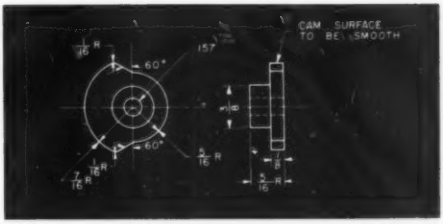

DROP OFF POINT MUST BE SQUARE WITH SIDE SURFACE AND BE SHARP
1/32
2 1/2
1.20
5/16
8
11/32
CAST 25)
SURFACE OF CAM IS A GENERATED CURVE EQUALING 120 PER REV.
PERIPHERY OF CAM TO BE SMOOTH WITH NO TOOLMARKS CROSSWISE

1. REPLACING A TWO PIECE STEEL assembly, this die cast cam meets all engineering requirements. The camming surface is a true involute and the drop-off clean and sharp. Except for reaming the hub bore, no machining is needed after casting. As cast, the surface is adequate. An added advantage of a die casting is greater reproducibility from piece to piece than was possible with machining and assembly. Saving of $ .15 per piece has been achieved.

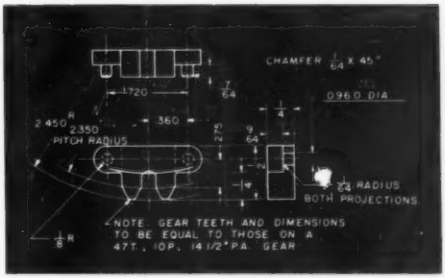
2. **IN SPITE OF CONSIDERABLE secondary machining, it is still less costly to die cast this spacer than to machine it from bar stock. Where tolerances are closer than 0.003, secondary machining is done to meet the requirements except on OD of the spacer and thickness, both of these tolerances are met by the foundry. Savings of $ .20 per piece are reported.**



3. **PLASTIC TO STEEL ASSEMBLIES ARE difficult to keep tight. This cam was such a problem; solved by a single die casting. Other than to ream the bore, no machining is required after the cam is delivered by the foundry. As in the previous cam, noted reproducibility from piece to piece is a die casting plus.**



4. **OCCASIONALLY DIE CASTING increases the cost of a part over other methods of fabrication. When it does, the advantages of the process must be outstanding to permit its use. The gear segment shown is one of those pieces. By normal machining and assembly methods, it was virtually impossible to secure either a reproducible tooth contour or an assembly that had the desired concentricity. Die casting gave a part entirely adequate in both of these departments.**



5. **ORIGINALLY DESIGNED AS A DIE casting, any other method of manufacture for this part would be economically impossible. As in other cases, the requirement of accuracy coupled with a high degree of reproducibility preclude the use of a cut gear and a stamping. Notable in this part is the thin section of the pointer ring. The 0.002 offset and the 0.003 deep recess both contribute to difficulty in making by any process other than die castings.**

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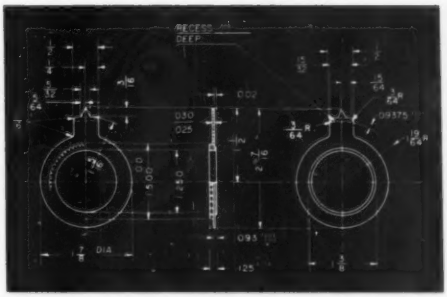
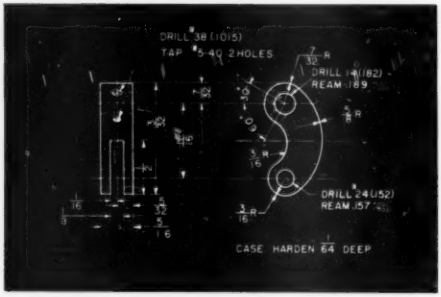


. . . these are better as SINTERINGS

CORNERS MUST BE SHARP
UNDERCUT OPTIONAL - SEE INSET
SURFACE FINISH(MAX.)
ANGULAR SURFACE — 60 R.M.S.
OTHER SURFACES — 125 R.M.S.
HOLE SURFACE — 60 R.M.S.
THIS CORNER MUST BE SHARP
OUTSIDE IS TO BE TRUE WITH HOLE WITHIN ±.002

6. **THE ABILITY TO MAINTAIN CLOSE tolerances and achieve a superior surface smoothness are two of the outstanding achievements of powder metallurgy. Both of these characteristics are exemplified in the washer shown made of iron powder and then impregnated with copper. A further saving resulted from molding the key as a part of the washer; previously a key-way and loose key were employed. Total savings per piece total $ .09.**



7. **WIDESPREAD USE OF IMPREGNATION of iron sinterings has opened an entirely new field to the powder metallurgist — the higher strength parts. The link arm shown is such a part. In addition to lowering manufacturing costs, the sintering displays superior wear resistance when compared with the steel part it replaces. Only the two No. 38 holes need to be drilled and tapped as secondary machining operations. Costs have been reduced $ .11 per piece.**

Head for soft-faced hammer by DIE CASTING

A SOFT FACED HAMMER of some sort is a standard tool of almost every mechanic. Whether his work involves the machining of components or assembling them there are innumerable occasions when a hammer must be used, but where the marring of the surface has to be avoided — for those jobs a soft faced hammer is greatly preferred to a standard steel hammer and a block of wood.

Generally lead is used as a facing material or for the entire head or bumper. It has the advantage of being soft and easily cast so that mis-shapen hammers can be reclaimed in the shop. A marked disadvantage is the high cost of the lead and the poor balance achieved.

Both of the major disadvantages of lead are overcome by the zinc die cast hammer illustrated. Made in a variety of weights, this soft faced tool will do all of the jobs lead does, is considerably lower in cost and is more easily used due to its better balance.

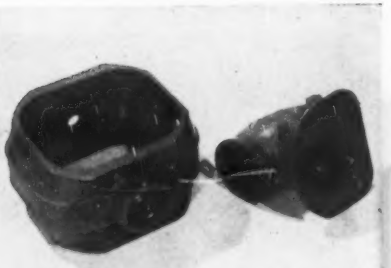
The hammer shown is made and distributed by the Gem Die Casting Co. of Denver, Colo.

Do You Know How To Make The Best Use Of

INVESTMENT CASTINGS?

QUESTION:
What types of materials can be precision investment cast? Is it possible to cast both ferrous and non-ferrous alloys?

ANSWER:
At Howard Foundry, practically every type of castable metal has been investment cast. These include aluminum alloys, most brasses and bronzes, monel, cast iron, low alloy steels, all types of stainless steels, stellites, Hastelloys and many types of tool steels.



Howard Foundry Company, successors to Allis-Chalmers for precision investment castings, is your best source for close-dimensioned, smooth-surfaced castings in many metals. The two aircraft structural investment castings shown above are typical of the thousands of parts being produced by Howard Foundry for American industry.

To find out whether a specific part can be investment cast, send us a drawing of the part and, if possible, a sample. Tell us the quantities required, type of material and permissible tolerances. Parts will be inspected and estimate furnished without cost or obligation.

- Send for our free brochure on Howard investment castings. You'll find it helpful.

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MODERNIZATION of slicers built by Sanitary Scale Company for the grocery and butcher trades has been centered largely about a transition from sand cast gray iron to permanent mold cast aluminum. Diverse considerations of function, appearance, cost and serviceability have entered into the design of this modern food-processing equipment. Figure 1. A group of major structural elements now being produced for Sanitary Scale Company by Ebaloy, Inc., of Rockford, Ill., are the six aluminum permanent mold castings displayed in Figures 2-4.

In some companies, redesign calling for new materials or manufacturing methods are specified by a cost-conscious engineering department over the arguments of sales executives who must then face the task of re-educating and re-selling their customers. This, however, has not been the case at Sanitary Scale. The sales department has been a most enthusiastic participant in the redesign because the new material and fabricating method have vastly improved the usefulness and sales features of the product. Customer acceptance has been immediate.

PERMANENT MOLD CASTINGS in aluminum help sell food equipment

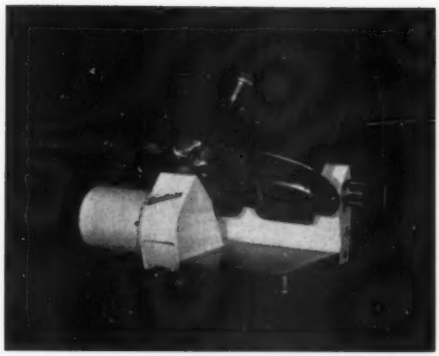
Here's what a *sales executive* sees in permanent mold . . .

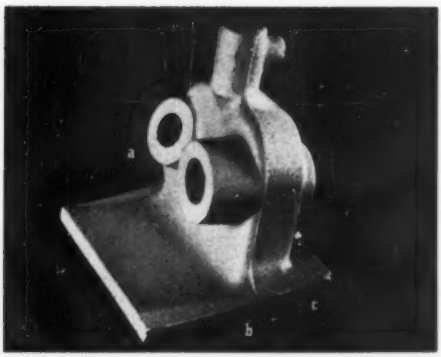
- **WEIGHT — Any salesman who has been carrying a back-breaking cast iron slicer from his car into a grocery store to make a demonstration, will be more than enthusiastic in his sales efforts for a lightweight aluminum unit weighing only a fraction that of cast iron. He knows how much easier it will be for the grocer to move, lift, clean or handle the slicer.**

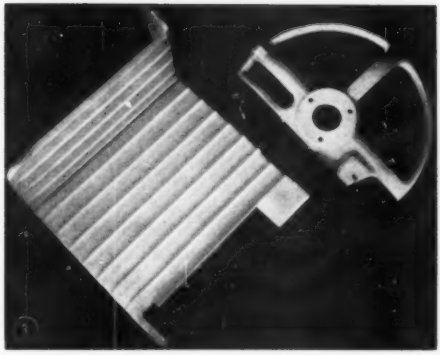
- **CORROSION — Red rust is unsightly, unsanitary attribute of cast iron, especially in the presence of moist foods. Paint or chemical surface inhibitors are, at best, temporary protection against food chemicals. Aluminum permanent mold castings, on the other hand, can be given a hard, durable coating of aluminum oxide by means of anodizing, and this self-sealing coating resists corrosion, remains satisfactorily bright, and is easy to maintain.**

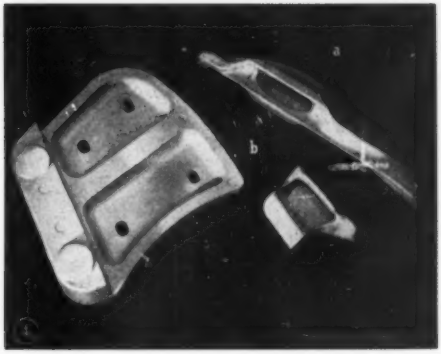
- **APPEARANCE — The light color, smooth surface and hard finish of anodized aluminum permanent mold castings have a favorable psychological effect, giving visual impression of the inherent corrosion-resistance and durability of the material.**

- **CLEANLINESS — Sand grains which leave small pits in the surface of sand castings trap food particles and dirt unless polished out. This necessitates all-over grinding and polishing. Permanent mold castings have a smoother surface generally require no grinding and little polishing.**









. . . and here's what a *design engineer* sees

1. **STRENGTH does not necessarily involve bulky materials. This slicing machine has all the strength of its cast iron predecessor without its mass or weight. Thin, rigid sections and metal-saving, hollow-cored thick sections are combined for maximum strength-to-weight ratio.**

2. **ODD-ANGLE coring is most easily accomplished by permanent mold casting, as in this mounting piece for the knife sharpening mechanism. Notice the two through holes, each at a different angle (A), the curved lower surface (B), and the non-perpendicular parting line (C) which make this an outstanding permanent mold casting.**

3. **SIZE is no problem in permanent mold casting. The right-angled tray (left) is large in area though thin in section. Notice the sharpness of detail and close-grained surface which are characteristic of these castings.**

4. **ECONOMICAL in the quantities required, permanent mold castings such as these three pieces involve relatively small tool cost, moderate piece price, and elimination of machining. Thin-edged casting (A) and two metal-saving cores (B) are of interest.**

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DIE CASTINGS resist fatigue under high frequency torsional stresses

IN some of the crystal cartridges made at Webster Electric Company, Racine, the needle chuck is one of the unusual parts found in the broad family of die castings. Probably no other method of manufacture could be used to make this part inexpensively so that it would perform as successfully as the aluminum die casting shown above.

This little casting is exceptional in several respects. In the first place, it operates under conditions that would tend to fatigue the metal if the magnitude of oscillation were greater, granted the frequency may be extremely high (upwards of 10,000 cycles per second). The vibratory motion imparted to the needle by the recording is transmitted through the chuck to the Rochelle salt crystal, and this strain in the crystal generates the electrical current, or as commonly used, the output of the pickup. With one end of the crystal firmly locked in place and the other end clamped in the chuck, the die casting itself is subjected to high frequency torsional stresses. Though these stresses are small, metal fatigue could possibly be a factor, but rarely have these die castings failed.

Both the needle hole and the clamp screw hole are cored by the foundry, the Racine Die Casting Company of Racine, Wisconsin. This particular job of coring is extremely difficult since the core pins are quite small, about 1/16 diameter and the other about 3/32 diameter, and tend to burn and bend. Wall thickness is only 0.025, making the problem of metal flow most difficult, especially in aluminum.

Mass of the chuck is important because the inertia must be kept as low as possible so that instantaneous response to change in either direction or magnitude is secured.

Small though this part is, it is an outstanding job of die casting, since it involves a majority of the most difficult problems encountered in the die casting foundry.

AN ANALYTICAL STUDY OF THE DIE CASTING PROCESS*

BRUNO SACHS, Ph.D.

FORCING of molten metal by the application of pressure into steel dies, the process called die casting, is by now an important factor in the economical mass production of non-ferrous metal parts. Progress in the method of production of die castings has followed empirical lines.

The purpose of this study was to provide the mathematical frame work for a working theory on die casting. In developing the theory, the die casting operation, also called "shot", has been followed through with as few simplifications as possible. The following factors have been accounted for: mechanical friction and flow losses in the die casting machine, the die and the cavity-air system; inertia forces; opening period of the operating valve and venting conditions in the die.

Based on fundamental laws of mechanics, hydro-and thermodynamics, a system of equations has been developed to describe pressures and velocities of the shot mechanism, die filling time, optimum gating and venting conditions, and the resulting porosity of the casting. These equations contain as parameters geometrical and physical quantities pertaining to the die casting machine, die and the metal.

The equations developed in the paper were then applied to the A. S. T. M. Committee B-6

continued on page 69

*Abstract reprinted from Dissertation Abstracts, Vol. XII, No. 4; Microfilm copy of the complete manuscript of 91 pages $1.14 (enlargements 6" x 8", 10c per page) from University Microfilms, Ann Arbor, Mich.

ELECTRODEPOSITION is a production process

By HAROLD RICE

WHAT DOES ELECTROFORMING OFFER the designer of precision metal components? Is it adapted to the manufacture of pieces in production quantities? What are its characteristics and how is electroforming accomplished? These are a few of the questions the editors of PMM have encountered in the field and, in an attempt to answer some of these queries, this article has been obtained from an authority in the field of electroforming. He finds that electrodeposition of metal is definitely a production process, capable of turning out large quantities of pieces at a predetermined schedule, and having certain features which are not otherwise attainable.

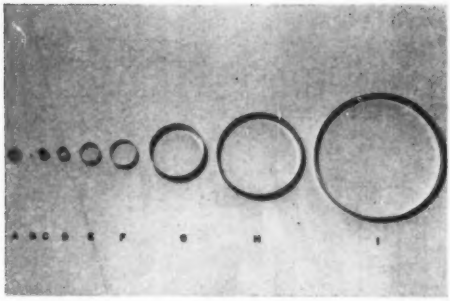
PRECISION control is now possible in metering orifices used in high pressure hydraulic systems through use of an unmachined hole. This orifice is accurate to ± .0002, has a surface finish of 5 micro inches, and is formed of non-corrosive electrolytic nickel.

During the past two years, electrodeposition has developed rapidly, and a number of defense projects are using the process for critical metal forming jobs.

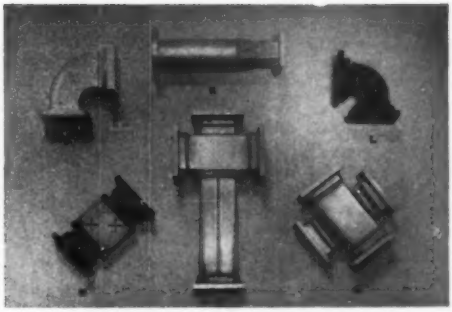
Advancement in electroforming techniques permitting greater accuracy, speed up of production and lower cost, now gives the engineer a new tool to work with. These changes now place electroforming in a class with other methods of fabrication for mass production.

In general, the engineer has regarded electroforming as a laboratory curiosity, precious for preparing samples and practiced by a few. Exhaustive research has brought forward a faster rate of deposition with modern pattern and assembly techniques. Together with special electrolytes and controls, lower costs are now realized. Engineers in the aircraft fluid metering and microwave field are now taking advantage of these facts.

Electroforming - Electrodeposition has been too closely associated with electroplating. In



1. PRECISION HOLES? Here are a few: A) .002 diam. spray nozzle; B) .020 diam. hydraulic restrictor orifice; C) .500 diam. air dash pot cylinder; D) 1.00 diam. viscosimeter; E) 1.75 diam. high pressure cylinder liner; F) 2.00 diam. float switch barrel; G) 2.87 diam. and H) 4.50 diam. concentric pressure switch cylinders; I) 6.75 diam. concentric barrel.



2. MICROWAVE COMPONENTS electroformed with flanges and iris plates: J) silvered copper elbow with brass flanges electroformed in position; K) silvered copper transition with flanges electroformed in position; L) copper nickel elbow with brazed flanges; M) wave guide connector with brass iris plate electroformed in position; N) large directional coupler in nickel; O) small directional coupler in nickel with aluminum flanges and insert electroformed in position.

reality, the final product and tne methods of fabricating are entirely different. The only common factor is electricity. To enable a clear understanding, the following definition is prepared.

Electroforming is the manufacture of metallic products by electrolytically depositing a heavy formation of metal against a pattern which has been rendered conductive. It permits reproduction of a pattern having intricate detail. The formation of heavy metallic deposits by electrolysis upon a conductive pattern may serve as a reinforcement to impart structural strength.

An electroforming process involves these basic steps:

1. A matrix is made, having an external surface with dimensions which are to be reproduced internally.
2. The matrix is mounted and treated chemically to render surface conducting.
3. The matrix is suspended from a cathode bar in an electrolytic bath.
4. Agitation of electrolyte adjusting the anodes, movement of the matrix is started, and current applied gradually.
5. Metal is electrodeposited until required thickness is obtained.
6. The unit is removed from the electrolyte, washed, cleaned, heated, and the electroform separated from the matrix.
7. The electroformed part must be cleaned of free salts and any treeing removed.

Many types of material can be used as mandrels or matrices. Our work has revolved around two distinct classes; one dealing with permanent mandrels in which case it is possible to draw or separate from the finished work and reuse; the other is an expendible mandrel and is separated from the electroform by either heat or chemical action.

Permanent mandrels should be divided in two classifications: 1. those relying on poor adherence of the conductive medium; 2. those where a parting compound or chemical reaction with the matrix produces the conductive surface. Both types are prepared in a similar manner, differing mainly in the material and the method of separation.

Type No. 1 are basically materials with a low coefficient of thermal expansion such as glass or special types of plastic. Mandrels of this class are machined slightly undersize and tin plated to the exact overall dimension.

continued on page 76

The Author

H. D. Rice has been associated with research for thirty-three years, and actively concerned with electroforming for the last fifteen years. Formerly with the United States Rubber Company, he was instrumental in introducing electroformed parts and new methods of fabrication to several industries. He is a chemical engineer and his wide experience in the research, development and marketing of electroforming qualifies him as an authority in this field. He is now technical director, Gas Precision Parts, Stamford, Conn.

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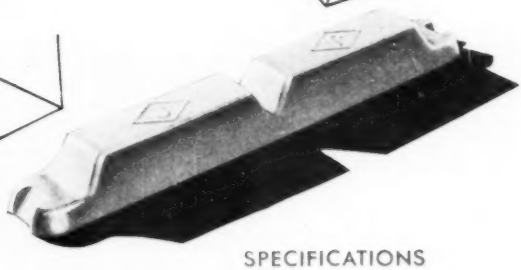

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SINTERINGS in business machines

- **Range of usefulness**
- **Procedures for converting**
- **Applications**

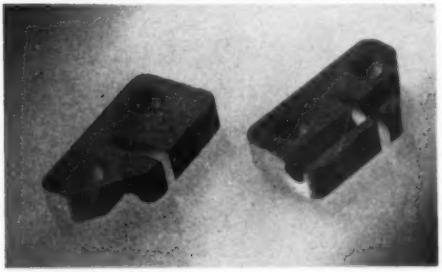
By **ANTHONY MEOLA***

THE average calculating machine has more than 4,000 parts which may be grouped generally into two classifications, punch press parts and automatic screw machine parts. During the past few years, Monroe Calculating Machine Company has been investigating the redesign of certain of these pieces as sinterings.

(Editor's note: The word "sinterings" is now used in PMM to designate parts made from metal powders. For details, see Nov. PMM, page 27.)

Some of the thinking behind this gradual introduction of sinterings into a production line where stampings and screw machine parts predominate, is offered here. At the present time, several parts are in actual production, others are undergoing preliminary testing, and a larger group is still being explored to determine feasibility, economy and serviceability.

Monroe has used sintered bearings for many years, but for other components, the process is quite recent. A long program of experimentation, cost analysis and consultation with suppliers has preceded the first application of sinterings for machine parts other than bearings.



1. "GREATEST CARE is exercised in redesign because minute details of weight, balance, surface and dimension have critical and cumulative effect upon performance . . ."

Range of usefulness for sinterings

The first step in considering sinterings as an alternate or substitute for another type of fabrication is to analyze the machine for parts which appear to have some basis for redesign. Naturally, a criterion for selecting prospective sinterings must be established, and it has been found that such parts are likely to lie within one of three categories:

1. Parts having high intermediate machining costs or subsequent operations;
2. Parts that are difficult to produce by conventional methods, or which interfere with the smooth flow of production line because of some unusual processing;
3. Parts in which an improvement in function can be expected.

There are also times when an abnormal metal supply situation motivates a search for substitute materials. The availability of some metals in powder form is likely to be better than in

*Chief Engineer, Monroe Calculating Machine Co., Orange, N. J.

wrought form at such a time.

It should be borne in mind that Monroe has its own punch press and screw machine facilities, but purchases sinterings from outside vendors with special facilities for producing these parts. In all cases, vendors must compete with in-plant stamping and automatic screw machine operations on costs.

Of the three categories listed, redesign in the first group is aimed primarily at saving money, the second group at relieving production line bottlenecks whether or not money is saved and the third group at improved performance.

Two of these categories of redesign are illustrated. Figure 1 is a bearing block in which a sintering has eliminated several precise machining operations and thereby produced genuine savings over its bar stock predecessor.

In Figure 2 are some small anchor nuts which were tooled up for production in nickel silver powder to relieve pressure on the company's automatic screw machines, but without cost advantage.

An example of the third category — improved performance — is not illustrated here, but might be a small, fast-moving machine part where the inherent porosity of a sintering is desirable functionally because of the reduction in mass.

Conversion procedures

Greatest care is exercised in redesigning parts from one type of fabrication to another. Minute details of weight, balance, surface and dimension have critical and cumulative effect upon the performance of the closely-integrated mechanisms of calculating machines.

Extensive performance testing precedes acceptance of a new material. These changes are initiated by and given final acceptance by the company engineering department.

Some time ago, studies were made to determine possibilities for conversion to sinterings during a period of metals shortages. More recently, another investigation was conducted for the purposes of cost reduction. In this study, 38 pieces were submitted to six different companies manufacturing parts from metal powders. Results, at the time of this writing, are as follows:

2 parts accepted by Monroe and/or on order with supplier,
9 parts acceptable by supplier at a cost saving to Monroe (based upon variable overhead and tools written off in one year),
1 part acceptable by supplier but at no cost saving,
17 parts rejected by supplier as impracticable or rejected by Monroe because of deviations which the supplier requested,
5 parts now under test by Monroe or being considered for test,
4 parts waiting quotation or status uncertain.

Applications of powder metallurgy

First application of sinterings other than as simple bearings, was the bearing block, Figure 1. This piece was, at one time, cut from a bar, drilled and milled. It was a slow, multiple set-up process which did not fit into production smoothly.

The piece is now being produced successfully by American Sintered Alloys Division of Yale & Towne at a reduction in finished piece price, and removal of the entire production operation from the Monroe plant.

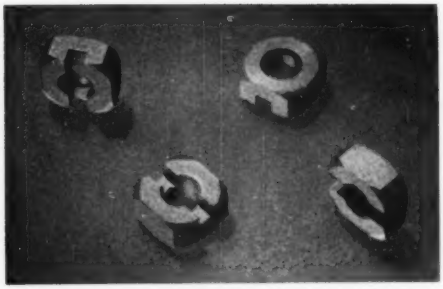
The piece is made from iron powder and is processed by black oxidizing and oil impregnating. Certain features of this small piece are critical. One of the two slots zones the motion of other components in three dimensional relationship. This slot is formed in the piece with an interference fit. The other slot which can be seen in the part, Figure 1, is formed with free running fit for an oscillating member that rides in it. Standard tolerances on this slot are maximum .004 and minimum .001 deviation.

This bearing block is now in regular production.

On the other hand, the small anchor nuts, Figure 2, have been tooled up, given complete testing and have received engineering approval, but are not currently in production.

Originally they were intended to relieve pressure on the company's automatic screw machines, but a changing production situation required that the part ultimately be kept on screw machines. A rapid secondary machine to slot and tap the pieces makes the screw machine

continued on page 74



2. "THE SCREW MACHINE produces nearly 50 percent chips whereas powder metallurgy is distinguished by an almost complete freedom from scrap . . . "

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Finishing Section

SURFACE FINISHING

Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.

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SHORTAGES AND ALLOCATIONS of finishing materials during the past several years have forced the development of many new types of metal finishes. Originally designed as substitute methods, many of these processes have become firmly stablished in industry. The so-called peroxygen compounds have been in the forefront of the chemicals used by these newer methods and, since the finishes obtained are applicable to products made by PMM processes, it is desirable that the finishes and methods of securing them be reviewed here.

Surface treatment of metals with PEROXYGEN COMPOUNDS

MANY surface treatments applied to metals involve the use of solutions containing oxidizing agents. These agents are mainly chromates or nitrates and the corresponding acids. In many other cases however, the use of peroxygen compounds offers advantages or is a necessity.

Peroxygen compounds useful for the surface treatment of metals comprise hydrogen peroxide, compounds forming hydrogen peroxide in solution, persulfates and peracids. The chemical and physical properties of these and other peroxygen compounds are fully described in technical bulletins.*

It is the purpose of this report to picture the role played by peroxygen compounds in treating metal surfaces. Complete coverage of the field has not been attempted and the various examples cited are meant to serve as illustrations only.

Inspection of published procedures for the treatment of metal surfaces with oxidizing agents indicates that these treatments can be grouped, although very roughly, according to the desired result.

- One type of treatment aims at producing an oxide film on the metal surface proper.
- A second type serves to remove undesirable components of the metal surface, which may be surface impurities generally or more specifically components of the metal surface itself.
- Somewhat overlapping with this is a third type of treatment applied to dissolve and thus remove metal from a metal surface.
- Oxidizing agents are also used in a somewhat different fourth type of treatment, where they serve to keep constitutents of certain treating solutions in the proper state of oxidation.

Staining and passivating

Peroxygen compounds are of actual or potential usefulness in all four types of treatments. Staining and passivating procedures may be given as examples for the first type of treatments. A typical staining treatment is represented by the "browning" or burnishing method of producing a brown to black surface finish on iron and steel. This is done on a large scale to finish small metal parts which lend themselves to an immersion treatment in the process solution.

"Browning" is a simple and economical way to obtain a relatively rust resistant finish on iron and steel and to improve the appearance of the finished article. An advantage of the process is that the dimensions of the article are not changed by the treatment. The treatment is quite generally carried out by immersing the pieces in a hot strongly alkaline solution containing an oxidizing agent. Sodium hydroxide is the alkali commonly used and a variety of oxidizing agents have been recommended. Among these are sodium peroxide or its equivalent, hydrogen peroxide. Mauermeyer[1] for example recommends a solution containing 300 to 400 g of sodium hydroxide per liter and 50 to 100 g of sodium peroxide (or about the

continued next page

*Available from Buffalo Electro-Chemical Co., Inc., Buffalo, N. Y.

same amount of commercial 50 percent hydrogen peroxide).

A highly durable **black finish for zinc and cadmium** is described by Nechamkin[2]. This finish can also be applied to other base metals after zinc or cadmium plating. The finish actually consists of a strongly adherent film of fine-grained copper oxide. The article to be treated is first immersed for a few seconds in a bath containing a soluble copper salt and a chlorate such as potassium chlorate. In a second step the article is treated with a hydrogen peroxide solution, which serves to increase both the blackness and the adherence of the finish. It is suggested that a treatment with a permanganate may preferably be applied after the first and before the second step. The three steps are repeated about ten times, each step consisting of an approximately 10 second dip in the respective solution, followed by a few seconds draining period.

Passivation of stainless steel by surface treatment is described by Kauffman[3]. Although stainless steels are generally resistant to various chemical solutions, they are attacked to an extent by solutions containing active chlorine. This attack is prevented by treating the stainless steel at room or elevated temperature with a solution of a persulfate. An aqueous solution containing about 1 to 2 g of potassium persulfate per liter is used for 8 to 48 hours at room temperature or for about 6 to 8 hours at temperatures between about 50 and 80 C.

Removal of surface components by oxidation

A method of **improving the electrical characteristics of the cuprous oxide** surfaces used in copper oxide rectifiers is disclosed by Hein[4]. This is an example of removal of surface components by oxidation. In this process the copper is first oxidized in a manner which leaves adjacent to the copper a layer of cuprous oxide, superimposed by a layer of cupric oxide. This latter is removed by acid etching and the resulting oxide surface is then treated for a few minutes with a solution comprising equal parts of ammonium hydroxide and hydrogen peroxide.

A copper cleaning process as reported by Terry[5] is a further example of a treatment of the second type. The oxidizing agent used here serves to oxidize relatively insoluble cuprous oxide, present on the surface of the copper article, to the more easily soluble cupric oxide. A slight corrosive effect of the oxidizing agent further promotes cleaning by causing a flaking off of insoluble foreign matter present on the surface.

TABLE 1
Typical Pickling Solutions

1000	ml of water
25	g of cresol disulfonic acid
100	ml of hydrogen peroxide 30%
850	ml of water
150	ml of sulfuric acid D 1.84
400	ml of hydrogen peroxide 30%
1000	ml of water
150	g of acid potassium oxalate
100	g of sodium perborate

The cleaning solution claimed to be particularly efficient is an aqueous solution containing 5 parts of sulfuric acid, 4 to 5 parts of hydrogen peroxide 30 percent and 3 parts of acetic acid in about 87 parts of water. Although hydrogen peroxide is the preferred oxidizing agent, a peracid such as peracetic acid might possibly be useful in this process, which is carried out by immersing the article to be cleaned for about 10 minutes at room temperature in the treating solution and following this with a water wash.

Another type of cleaning solution is described by Durgin[6] as useful for **cleaning tin, zinc and aluminum surfaces without etching** or discoloring such surfaces. The cleaner is essentially a mixture of 63 parts of trisodium phosphate, 25 parts of sodium silicate of low alkali ratio, 2 parts of magnesium sulfate and 10 parts of sodium perborate. For this last named ingredient other hydrogen peroxide addition compounds compatible with the rest of the mixture could be substituted. The cleaner is employed in aqueous solution of optional concentration.

Belonging to the same type of treatments is a process for **rust removal and pickling of iron** or its alloys invented by Schering[7]. This process permits pickling or rust removal in such a manner that the exposed iron surface is left light and shiny, thus avoiding the need for mechanical finishing operations to improve surface appearance. It is essentially a standard acid pickling process, employing acids such as sulfuric or phosphoric and others. However, the novelty of the process resides in the fact that peroxygen compound is added to the pickling acid and this accounts for the satisfactory appearance of the surface directly after pickling and without further mechanical treatment. Typical examples of the pickling solutions used here are offered in Table 1.

Removal of undesirable surface impurities, especially from cooking and eating utensils made of silver or plated with silver, is the object of a patent taken out by Rauh [8]. It is known that such metal utensils sometimes acquire an unpleasant taste or odor which is not removed by the usual washing and cleaning procedures. The objectionable taste or odor is mainly due to organic sulfur

compounds firmly adhering to the metal surface. These compounds can be removed by surface oxidation, which, of course, has to be carried out so as not to damage the utensil. This is possible by immersing the utensils in a hot solution of dilute hydrogen peroxide or by polishing them with a composition consisting of mild abrasives in mixture with solid peroxygen compounds such as sodium carbonate perhydrate, sodium perborate and others. A particularly efficient product is said to be obtained by incorporating urea peroxide in the polishing mix described above.

Dissolving or removing metal surface

Etching and stripping procedures belong to the third type of treatments mentioned above. Their principal purpose is the removal of all or part of a given metal surface or metal layer. The use of hydrogen peroxide is well established for etching specimens in the metallurgical laboratory; persulfates are also used for this purpose. Alkaline hydrogen peroxide solutions are used for the etching of carbides, nitrides, tungstides. In the macroetching of iron and steel, ammonium persulfate solutions help to show details of metal structure for visual inspection. Hydrogen peroxide and ammonium persulfate are also used in the etching of copper and its alloys[9].

TABLE 2

Typical Stripping Solutions

Brass from steel:	
Gold from copper, nickel and iron or their alloys and steel:	
Lead from silver [12].	
Ammonium persulfate	75 g
Ammonium hydroxide	335 ml
Water	665 ml
Sodium cyanide	2 oz
Water	1 pt
Hydrogen peroxide 30%	½ oz
Glacial acetic acid	1 vol
Hydrogen peroxide 5%	1 vol
Water	3 vol
Clacial acetic acid 85%	by vol
Hydrogen peroxide 30% 5%	by vol

The **properties of electrical contacts** made from metal compositions comprising a refractory compound, such as tungsten carbide, and a fusible metal, such as copper, are improved by etching their surface with a solution containing about 15 to 30 percent of hydrogen peroxide and about 8 percent of ammonium hydroxide[10].

Peroxygen compounds are also useful for **stripping a metal-coating** from a base metal. Some typical stripping solutions are listed in Table 2.

Bright dip process

The so-called "bright-dip" processes are related to the etching and stripping procedures outlined above. They brighten a metal surface by chemically removing high spots and other surface irregularities and also help to remove surface contaminants. Here again, peroxygen compounds are useful.

Hydrogen peroxide in acid solution was found to be an efficient brightening agent, particularly to **brighten zinc and cadmium** surfaces, which are also made more strain-resistant

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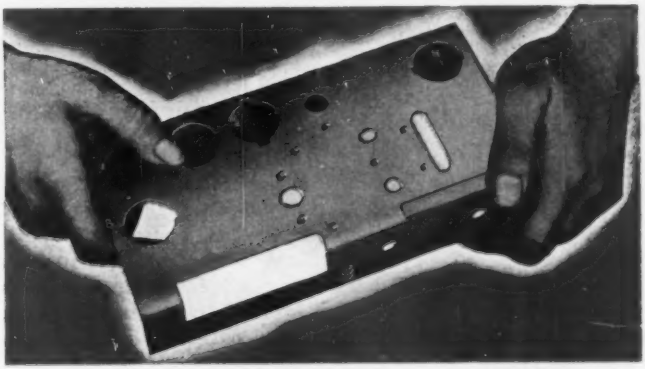

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the bath is very important. A recommended bath contains in water solution 4 percent hydrogen peroxide and 0.25 percent sulfuric acid by weight and is applied by immersing the article to be treated for about 15 seconds in the bath, followed by a water rinse.

Another **bright dip for zinc** is reported by Oplinger[14] and employs a solution containing 2 to 5 percent by weight of hydrogen peroxide together with either 2 to 5 percent of sulfuric acid or 2 to 4 ounces per gallon of sodium cyanide.

Brightening and passivation of cadmium by means of acidic solutions of hydrogen peroxide is described by Kepfer[15]. He uses a solution containing hydrogen peroxide and sulfuric acid in specified ratio, the proper ratio of 4:1 being of greater importance than chemical concentration. Instead of sulfuric acid, potassium persulfate may be used in conjunction with hydrogen peroxide. It is quite possible that in such a bright dip the use of a peracid might bring certain advantages.

Still **another bright dip for cadmium**[16] employs a solution containing per gallon of water 6 oz. of hydrogen peroxide 30 percent and 1 oz. of concentrated sulfuric acid, or more generally a solution containing hydrogen peroxide and sulfuric acid in the ratio of about 1.6:1.

An example for the fourth type of treatment mentioned above is the use of hydrogen peroxide to control the chemical composition of the process solutions used in phosphatizing iron and steel.

Iron and steel articles are frequently protected against corrosion by applying a phosphate coating, more particularly a zinc phosphate coating. This may be done by treating the article to be coated with a warm solution of zinc oxide and phosphoric acid in water. A ferrous article, however, in contact with phosphoric acid, will shortly react with that acid to give rise to formation of ferrous phosphate with simultaneous liberation of hydrogen. As the coating bath is preferably kept close to pH 3, the ferrous phosphate will remain in solution, unless oxidized to ferric phosphate, which, being insoluble above approximately pH 2, will precipitate out and can then be removed with the sludge or by filtration. Interference of soluble ferrous phosphate with the desired zinc phosphate coating can, therefore, be prevented without introduction of foreign ions into the bath by hydrogen peroxide oxidation of the ferrous to ferric phosphate.

The amount of hydrogen per-

continued on page 76

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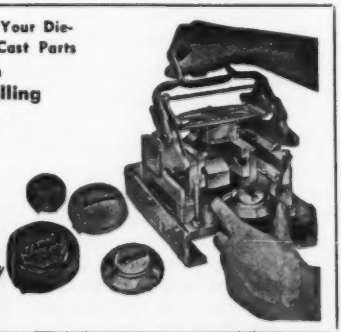

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For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

PROCESSES

Investment Casting Data Sheet: **No. 144**
A new, notebook size data sheet from Casting Engineers gives background information on investment casting, including tolerance range, design recommendations, alloys and tooling.

MATERIALS & EQUIPMENT

Die Casting Machine Catalog: **No. 145**
In a clearly-illustrated catalog of die casting machines to produce "any size casting," Cast Master, Inc. gives detail views of special features on their machines. Basic features are indicated on enlarged views of the machines, and a specification tabulation gives information on plunger gooseneck and cold chamber type machines.

Lathes, Drill Presses, Shapers, Etc.: **No. 146**
An 88-pg catalog from South Bend Lathe Works gives photographs, descriptions & specifications for their full line of lathes, drill presses, shapers & accessories.

Simple Heat Treat for Tools & Dies: **No. 147**
A folder, "How to Use Hard N'Tuff" explains how this steel hardening compound provides rapid carburizing, nitriding & chromizing with a simple treatment. Increase in tool life by 300% is guaranteed by Doughty Laboratories, makers of the substance.

New Magnesium-Zirconium-Zinc-Thorium Alloy: **No. 148**
Announcement of a new light alloy that will withstand operating temperatures up to 650F has been issued by Howard Foundry Co. in a technical data sheet on ZT1 magnesium-zirconium-zinc-thorium alloy. Material designed for jet engine castings.

Blending Sand & Resin for Shell Molding: **No. 149**
To help users of the new shell molding process obtain uniform blending of fine sand & phenolic shell-molding resins, the Patterson-Kelley Co., Inc., offers a new 4-pg bulletin on their twin shell dry blenders.

Proportional Mixer with Adjustable Jet: **No. 150**
A bulletin from Eclipse Fuel Engineering describes their new Vari-Set proportional mixer with adjustable jet which simplifies heating changes on combustion equipment using low pressure gas and air.

Complete Line of Air Cylinders: **No. 151**
The complete line of air cylinders manufactured by the Lindberg Engineering Company is presented in new bulletin No. 731 which includes diagrams, charts & photographs to explain capacity, type of mounting, etc.

Drill Stops: **No. 152**
Drill stops that provide positive control for hole depth are described & illustrated in a 4-pg bulletin from Scullly-Jones & Co.

FINISHING

Procedure for Removing Oxide Scale from Copper: **No. 157**
A new procedure for removing oxide scale from copper & its alloys is contained in an instruction brochure from Enthone, Inc., by use of the company's Ebonol "C" treatment.

Aluminum Bright Dip: **No. 158**
Full information concerning Alchemize aluminum bright dip has been made available in 4 pages of operating instructions and data from Kaynide Division of Kraft Chemical Co., Inc.

Steps Toward Better Electroplating: **No. 159**
In a 28-page booklet from Oakite Products are presented "Four Good Steps Toward Better Electroplating on Steel." The compact booklet gives information on precleaning, rinsing, reverse current cleaning and the use of Oakite Composition No. 90.

Metal Cleaning Equipment: **No. 160**
New 4-pg bulletin from Topper Equipment Company is devoted to the complete line of Circo metal cleaning equipment, including vapor degreasers, vapor spray degrreasers, liquid-liquid-vapor degreasers, pit type and conveyorized degreasers.

How to Finish Magnesium: **No. 161**
In a fully-detailed technical data book, Dow Chemical Company offers information on how to finish magnesium. Finishing systems for magnesium die castings, sand castings, permanent mold castings and wrought products are included.

Automatic Polishing & Buffing Machines: **No. 162**
In an over-size folder, Acme Manufacturing Company presents more than 20 different models of automatic polishing & buffing machines and also adjustable floating head polishing & buffing lathes. Both straight line & rotary automatics are included.

Testing Products in Florida Climate:
A booklet from South Florida Test Service outlines and illustrates the company's services for testing products under the severe exposure conditions of southern Florida.

Blast Cleaning & Dust Collection in Pocket Handbook: **No. 164**
A convenient pocket-sized handbook from Pangborn Corp. illustrates the company's line of small "standard units' for blast cleaning and dust collection. Unique booklet has 2 front covers, one opening into blast cleaning pages, and turning the book upside down shows the second cover devoted to dust collection.

UNICHROME Trade Mark

News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

By compensating for nickel with other materials

Chromium Plating Still Gives a Lasting Finish

OUTSTANDING PRIMER FOR ALUMINUM AND MAGNESIUM

In test after test made by outside concerns, Unichrome Primer AP-10 has come through as the one which affords greatest protection to light metals and increases durability of top coats. It adheres through weathering, salt and fresh water immersion without blistering, undercutting or cracking, and is highly recommended by well known producers of aluminum and magnesium for use prior to painting or enameling.

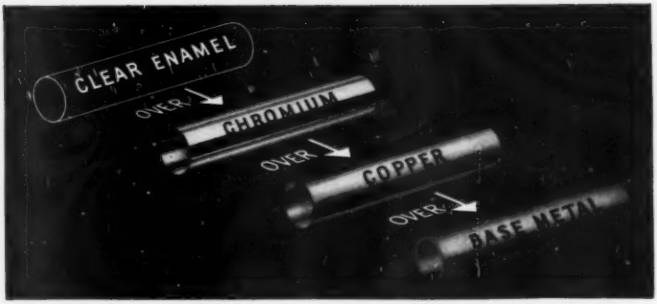
COPPER PLATING PROCESS IMPROVED

The wide current density range at which the Unichrome Pyrophosphate Copper Process plates smooth and fast is maintained over long periods of continuous operation by an improvement in its makeup.

In addition, this process continues to solve other plating plant problems. It can be used in plastic lined tanks formerly used for nickel. It can be plated directly with chromium, with only simple buffing or chemical polishing if needed. It contains no cyanide to dispose of.

ZINC FINISH STAYS BRIGHT AS CHROMIUM

Zinc plate, when chemically treated in Unichrome Clear Dip and then fortified with a Unichrome Clear Enamel, provides a substitute finish which can satisfy exacting requirements. The Clear Dip forms a bright-as-chromium finish integral with the zinc, while the clear enamel adds extra wear and corrosion resistance to this protective finish without detracting from its brightness. This successful finishing system is in widespread use today on zinc die cast and steel products.



Despite scarcities, many products still offer the powerful appeal of a good quality chromium finish. One method for producing such a finish offers substantial advantages. Corrosion resistance is achieved with alternate materials — copper for the undercoat, organic coating for a topcoat. As for the chromium itself, better, faster plating is being obtained with the Unichrome S.R.H.S. Chromium Bath.

PRODUCTION ADVANTAGES WHEREVER USED

Many plants are plating to specifications with Unichrome S.R.H.S. Chromium 20 to 80% faster than with the ordinary chromium bath — and with less trouble. Self-regulating, it minimizes control and maintains top throwing power. With wider bright plate range, it avoids rejects due to "burning" or "missing." Recent reports give some idea of the great improvements this bath has worked on production, costs, and results:

Fishing line guides are plated in 2/3 the time by S.R.H.S. Chromium, and with better coverage and brighter plate. By using this bath, another plant doubled capacity for plating various parts including zinc die castings — and eliminated the former need for special racking. Companies report savings in bath maintenance, too.

A GOOD COPPER UNDERCOAT

Copper plating on zinc die castings and steel contributes to corrosion resistance, and to a brighter finish. Copper deposited from the Unichrome Pyrophosphate bath makes an excellent base for the chromium. If base metal condition and quality requirements permit, it needs no buffing or chemical polishing. If not, it can be easily polished either way.

CLEAR "ENAMELS" COMPLETE THE SYSTEM

Unichrome Clear Coatings were developed especially for use on plated and polished metals. They add extra protection without detracting from brightness.

Baked-on Coating B-115, while virtually invisible, protects against moisture, handling, corrosives, and wear.

For an air dried or force dried finish, Unichrome Coating A-140 provides corrosion-resistance comparable to many coatings that are baked.

Unichrome Coating B-159 also gives outstanding service. A well known manufacturer for instance, is using it on chromium plated refrigerator shelves and is getting not only superior protection but also twice the film thickness at half the cost of the coating formerly used.

An engineer from United Chromium will gladly give full details on this proved system for finishing with chromium. Write or phone.

UNITED CHROMIUM, INCORPORATED
100 East 42nd Street, New York 17, N. Y.
Detroit 20, Mich. • Waterbury 20, Conn.
Chicago 4, Ill. • Los Angeles 13, Calif.
In Canada:
United Chromium Limited, Toronto, Ont.

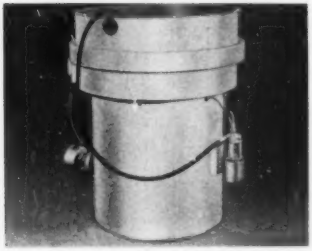
PMM NEW PRODUCTS

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

SEMI-PORTABLE DEGREASER

Detrex VS Jr.

Detrex Corporation



SPECIAL FEATURES: Compact unit designed especially to clean small and medium sized parts; suited for small plants & shops where production up to 600 lbs. steel per hr. must be processed.

SPECIFICATIONS: Built in 2 standard manually operated models, one electrically heated, one steam heated. Parts are suspended in pure solvent vapor; spray of hot solvent flushes off loose soils; rinse in solvent vapor leaves work thoroughly clean. Work placed in baskets or on hooks; unit is 48" from top to base for convenient working space; interior of equipment coated with non-porous, corrosion-proof material.

For additional information Circle No. 196 on Reader Service Card

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MASKING TAPE FOR ANODIZED SURFACES

Brady Quick-Masks

W. H. Brady Company

SPECIAL FEATURES: Recently developed self-sticking industrial masking tape for painting & plating; pre-cut to exact size & shape to mask specific surfaces. Special feature is adhesion to anodized surfaces during high temperature baking cycles.

SPECIFICATIONS: Principal applications of Quik-Masks said to be anodized aluminum, pickled magnesum, dichromated magnesium & similar metal parts, especially castings. Masks are die cut from Minnesota Mining & Mfg. Co.'s No. 214 paper masking tape. Stands temperatures in excess of 400 F. Reported to correct defect of ordinary masking tapes which have soft adhesives that migrate into etched grooves of anodized surfaces.

For additional information Circle No. 211 on Reader Service Card

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IMPREGNATING METHOD "FILLS" MICROPOROSITY IN CASTINGS

Polyplastex MC

Polyplastex International, Inc.

SPECIAL FEATURES: Hundred percent filling of voids & microporosity in castings by use of special thermosetting resin designed to overcome disadvantages of low-solids sealants. Polyplastex MC reported to utilize 100% solids sealant for greatest sealing efficiency and lowest cost.

SPECIFICATIONS: All of sealant converts to solid having excellent physical & chemical properties so that when liquid resin fills pores, it occupies same volume after solidifying. Cured resin resists solvents, water, salts, hydrocarbons, glycols, acids and weak alkalies and stands continuous exposure to temperatures up to 350 F. Any of four impregnating techniques can be used: external vacuum, internal vacuum, internal pressure or vacuum & pressure.

For additional information Circle No. 197 on Reader Service Card

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STURDIER COLUMN & BASE FOR 2-SPINDLE DRILL

Model MC-20

Sibley Machine & Foundry Corp.

SPECIAL FEATURES: Sturdier column & beefed-up base for improved rigidity & stamina are features of improved design for 2-spindle, 20" swing drilling

continued next page

LOW COST
IRIDITE
FINISHES

for zinc, cadmium, aluminum and cuprous metals

provide corrosion resistance
paint base
choice of appearance

And they are easy to apply! Just a simple chemical dip for only a few seconds produces the coating.

LOW MATERIAL AND SHIPPING COSTS

combine to make Iridite the most economical chromate finish you can buy. Many Iridite chemicals are packed in powder form, thus can be shipped to you in steel pails at freight savings of up to 75%! Pails take less storage space, are easier to handle, eliminate carboys, need not be returned.

WHY NOT TEST IRIDITE ON YOUR PRODUCTS? Write for literature and send samples for free test processing. See "Plating Supplies" in your classified telephone directory or write direct.

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD.

For additional information Circle No. 40 on the Reader Service Card

NEW PRODUCTS — cont.

machine with 1¼" capacity in mild steel. Also reported to have good sensitivity for small size drills.

SPECIFICATIONS: Dial indicator for easy selection of geared power feeds; spring-loaded lever for changing the 8 spindle speeds of 65 to 1360 rpm.

Circle No. 198 on the Reader Service Card

TILTING TUMBLING BARREL MAGNIFIES TUMBLING ACTION

Hupp Corp., Globe Division

SPECIAL FEATURES: New addition to Globe's line of tumbling barrels is flask-type, direct motor drive, tilting tumbling barrel for deburring & burnishing precision metal parts, both ferrous & non ferrous. New unit is said to magnify tumbling action due to restrictive nature of flask-shaped design, concentrating load in smaller working area.

SPECIFICATIONS: May be used with all types of deburring & burnishing media; available in capacities up to 750 lb.; flask-type barrel is of continuous welded sections of heavy steel plate with ¼" lining of abrasion-resistant rubber. Direct drive provided with 1 hp motor directly above worm segment for balance & economy; available with single or variable speed motor. Tilt angle of barrel adjustable for smooth or violent tumbling action. Speeds as low as 17 rpm for nonferrous metals & plastics. Free experimental metal finishing service; samples processed and complete report made with recommendations.

Circle No. 199 on the Reader Service Card

WET BLAST CLEANER FOR DIES & CASTINGS

Model 614 Liquamatte
American Wheelabrator & Equipment Corp.

SPECIAL FEATURES: Precision cleaning & finishing wet blast machine designed for die casting dies, forging

dies, molds, as well as blending aluminum surfaces, deburring and cleaning of castings.

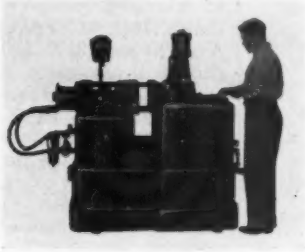
SPECIFICATIONS: Fine mesh abrasives suspended in water are propelled at the work by compressed air; close-tolerance dimensions are maintained as are sharp corners, lines & lettering, flat surfaces, knurling, thin sections & other normally vulnerable areas. Machine size: 6' long x 6' 10½" deep x 8' 11" high; handles single pieces or loads to 3500 lbs; has two 49" x 36" counterbalanced doors & 6' accessory tank to receive parts from blast chamber for rinsing.

Push-button controls, vertical slurry pump are among features. Armholes equipped with gauntlets so workman can use his own gloves. No slurry drips on front of cabinet.

For additional information Circle No. 200 on Reader Service Card

1000 SHOTS-PER-HR MACHINE FOR SMALL ZINC DIE CASTINGS

A B C Die Casting Machine Co.



SPECIAL FEATURES: A new air-operated small die casting machine has been added to the line manufactured by A B C Die Casting Machine Co. This 1½-lb. zinc machine is capable of free cycling speed in excess of 1000 shots per hour.

It has an electrically-controlled panel; 10" x 10" x 2" die blocks, four tie bars, and semi-automatic cylincal with adjustable timing dwell on opening and closing of the toggle.

For additional information Circle No. 210 on Reader Service Card

NEW PRODUCT BRIEFS

201. SENSITIZED TRACING CLOTH of high flexibility, transparency & durability for photo reproduction of drawings, etc., is available in white or blue in wide range of rolls & cut sheets.

202. SHELL MOLD ADHESIVE for bonding halves of shell molds offered by World Bestos, is applied to mold as film or liquid and, when heat-cured, securely bonds the halves, eliminating need for clamps.

203. MICRO-ALIGNMENT TELESCOPE for optical tooling is available with built-in reflection unit. Engis Equipment builds unit has integral optical micrometers & can check point alignment to .001 accuracy over distances from 18" to 150'.

204. ROTARY WORK TABLE for small, precision pieces now offered by South Bend Lathe for drill press, milling machine, shaper or surface grinder.

205. MASTER COPY DIAL that provides 41 characters for quick change engraving in any engraving machine offered by H. P. Preis Engraving machine Co. Speeds engraving of letters & numerals in dies. Several styles of type available.

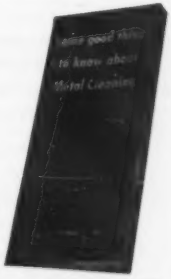
206. CHANGING HEATING LOADS on combustion equipment is simplified with Vari-Set Mixer from Eclipse Fuel Engineering Co. Built-in, adjustable orifice eliminates replaceable jets & changes volume of automatically proportioned gas & air for any BTU output within capacity of various sizes of mixer.

207. CHROME PLATE MICROMETER, with sharp & clear graduations against a dull chromium background is available from George Scherr Co. Tungsten carbide tipped anvil is an exclusive feature.

208. CONTINUOUS FEED WEIGHER for finely divided material such as metal powder automatically & continuously transports, weighs & maintains preset rate of feed. Made by Sintering Machinery Corp., Transportometer Div.

209. DRILLING 7 HOLES at one time is a feature of a new Govro-Nelson drilling machine built to drill 5 radial holes and 2 parallel holes simultaneously. Accurate location of holes, and output of 500 parts (3500 holes) per hour are features.

Which job would you like to improve?



Listed below are some jobs discussed in Oakite's new 44-page illustrated booklet on Metal Cleaning. Let us help you do them with better results, greater economy.

OAKITE PRODUCTS, INC., 34G Rector St., New York 8, N. Y.

Tell me (without obligation on my part) about Oakite methods and materials for the following jobs:

- ☐ Tank cleaning
- ☐ Machine cleaning
- ☐ Electrocleaning
- ☐ Pickling
- ☐ Pre-paint treatment
- ☐ Paint stripping
- ☐ Steam-detergent cleaning
- ☐ Barrel cleaning
- ☐ Burnishing
- ☐ Rust prevention
- ☐ Send me a FREE copy of your booklet "Some good things to know about Metal Cleaning"

NAME.....

COMPANY.....

ADDRESS.....

Technical Service Representatives in Principal Cities of U. S. & Canada

OAKITE SPECIALIZED INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE

For additional information Circle No. 76 on the Reader Service Card

Designed for Speed • Precision • Compactness

The AIR CYLINDER

with the *Built-in Valve*

Air engineers agree: the closer the valve to the cylinder, the more efficient is air cylinder operation. In the Bellows Air Motor the valve, and all operating controls, are an integral part of the cylinder itself.

This built-in construction means quicker action, more positive response, surer control, and more economical operation. Built-in construction means compactness, simplified installation, minimum maintenance.

The Bellows Air Motor is made in five bore sizes: 1¼", 1¾", 2½", 3⅛" and 4½", and in any stroke length, with either the built-in Electroaire Valve* for remote control electrical operation, or with the built-in manual valve for hand and foot operation or for mechanical linkage to a machine element. Wide range of mounting styles.

Write Today for this free 32-page booklet. Dimensional specifications, technical data, wiring diagrams, case history studies, production and cost data. Address: Dept. PMM-1252, The Bellows Co., Akron 9, Ohio. Ask for Bulletin CL-30.

The Bellows Co.
ESTABLISHED 1911
AKRON 9, OHIO

"Controlled-Air-Power"

*TM REG. 1335

FOR FASTER, SAFER, BETTER PRODUCTION

For additional information Circle No. 41 on the Reader Service Card

CORRECTION

In the article, "Chromate Surface Treatment for Precision Molded Aluminum," Part I of which appeared in the October issue of PMM, an error is reported. Under the heading *General properties* on page 62, the first sentence reads "The Iridite film is an organic amorphous complex chromate". . . . The fact is that this is an *inorganic* complex chromate.

PAUL KIRCHARTZ SETS UP FINISHING COMPANY

Paul E. Kirchartz, formerly Eastern manager of the Almco Division, Queen Stove Works, Inc., has announced formation of his own company, Metal Finish, Inc., 410 Frelinghuysen Ave., Newark 5, N. J. The company will engage in all phases of work in the precision metal finishing field.

Engineering, sales and service are included in the field of activity for the new concern. They will serve as sales agents for barrel finishing equipment and materials.

COWLES CHEMICAL ELECTS W. M. CLOSSEY

William M. Clossey has been elected secretary and treasurer by the board of directors of Cowles Chemical Company, Cleveland, Ohio.

Mr. Clossey was secretary and treasurer of Broadhead Garrett Company in Cleveland just prior to joining Cowles and before that was a supervising accountant for Ernst & Ernst. He is a member of the Ohio Society of Certified Public Accountants.

REFERENCE MATERIAL, catalogs and data offered free in this month's ads (circle numbers on reader service card.)

4. PRECISION CASTINGS from frozen mercury patterns described in bulletin from Alloy Precision.

7. DIE CASTING MACHINE catalog showing complete line of equipment is offered by Cast Master.

8. SMALL DIE CASTINGS produced by a specialized department of Dollin Corp. are subject of a booklet. Sample castings included.

10. DATA FOR THE DESIGNER of die castings & pictures of Hoover Co.'s die casting facilities are in a booklet from Hoover.

11. INVESTMENT CASTING questions & answers plus many examples of investment castings are in a brochure from Howard Foundry's investment casting division.

13. PROPERTIES OF NEW ALLOY of aluminum are listed in a brochure on Almag 35 from Wm. Jobbins.

14. SAFE OPERATING TEMPERATURES for hydraulic fluids in die casting machines by use of heat exchangers discussed in Kewanee-Ross booklet.

16. LATEST NEWS on die casting machines & plastic molding presses in regular publication, The Lester Press, from Lester-Phoenix.

18. ALUMINUM CASTINGS with attractive Velva-Glaze finish reported in booklet from Monarch.

19. NON-FLAMMABLE FLUID for die casting machines reviewed in 12-page booklet on Pydraul F-9 from Monsanto.

26. ALUMINUM MELTING FURNACES and an aluminum heat content chart are in complete catalog from Stroman Furnace.

28. DATA ON SINTERED PARTS from Yale & Towne includes custom-made metals, complicated designs, physical properties, unusual tolerances.

29. BARREL FINISHING is discussed in 3 booklets from Almco Div., Queen Stove Works, covering process, materials, equipment.

30. NEW TYPE CONTACT WHEEL that cuts abrasive belt loading, increases belt life, reported in literature from Carborundum.

31. NON-ETCHING ALUMINUM cleaner & powdered acid type deoxidizer for aluminum covered in data sheets from Cowles Chemical.

32. CLEAR ENAMEL OVER CHROMIUM over copper over base metal is the durable finishing system described in literature from United Chromium.

33. PLASTER MOLD CASTINGS in many alloys produced to close tolerances reported in data book from Atlantic Casting & Engrg.

36. FACILITIES FOR PRODUCING powder metal parts & review of the scope of powder metallurgy from Michigan Powdered Metal Products.

38. POWDERED METAL PARTS, their production & uses, are described in bulletin from Powdered Metal Products Co.

40. IRIDITE PROTECTIVE systems for corrosion-resistant metal surfaces are outlined in brochure from Allied Research Products.

41. AIR CYLINDERS — diagrams, complete specs, detail drawings — are the subject of 32-pg brochure from Bellows Co.

42. BARREL FINISHING using materials & equipment from Minnesota Mining & Mfg. Co. is explained in a booklet.

47. CENTRIFUGAL INVESTMENT castings produced by Electronicast are the subject of a folder telling about the process & its applications.

48. ZINC ALLOY SUPPLIERS, Henning Bros. & Smith, offer a monthly house organ called The Henning Messenger.

49. HOW TO DESIGN aluminum & magnesium die castings is the subject of a data book from Litemetal Dicast.

53. KEEPING COPPER-PLATED PARTS clean by use of a special Water-Dip is subject of literature from Maas & Waldstein.

54. DIE CASTINGS FOR DEFENSE is the subject of a booklet, "We're Geared for Your Defense Needs" from Advance Tool & Die Casting.

55. ALLOYS FOR INVESTMENT casting are described in literature from Cannon-Muskegon.

57. GRAY IRON PERMANENT MOLD casting as a means of cutting product costs is subject of literature from Dostal Foundry.

59. SMALL DIE CASTINGS — review of size, alloy & design limits — in folder from Gries Reproducer.

61. DESIGNING FOR POWDER metallurgy is subject of handbook from International Powder Metallurgy.

63. STANDARD SINTERED BEARINGS from stock are listed in booklet from National Molded Products.

68. CHROME-LIKE BRILLIANCE & methods for applying it to zinc surfaces reported in literature from Chemical Corp.

70. SOLVING PROBLEMS with investment castings is subject of booklet offered by Hitchiner.

71. ELECTRIC FURNACES for small batch melting in investment casting process are subject of literature from Detroit Electric Furnace.

72. REFERENCE FOLDER on a line of P-V investments for the investment casting process is offered by Pre-Vest.

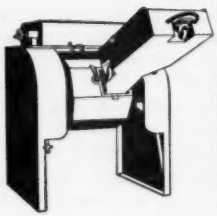
73. HOW TO HEAT WAX for making investment casting patterns can be learned from literature available from Sta-Warm Electric.

76. SOME GOOD THINGS to know about metal cleaning is title of booklet issued by Oakite Products.

80. TOOLS FOR DIE WORK & a regrinding service are in "All Star" catalog from Severance Tool Industries.

continued next page

SUPER-HONITE CHIPS NEVER QUIT CUTTING!



THE LONGER THEY'RE USED, the sharper they get! "Super-Honite" Chips can't wear smooth. New cutting edges are constantly exposed as surface areas are slowly reduced.

Longer lasting, too. These improved barrel-finishing chips—composed of aluminum oxide grain with ceramic non-crystalline bonding agent—*outlast other aluminum oxide chips two to one.* And, because of their completely uniform composition, used chips can be re-graded for different finishing operations.

Try "Super-Honite" Chips on your next deburring or burnishing job. Get higher-lustre finishes at lower unit costs. Prove it to yourself.

TOUGHEST NATURAL CHIP! Use Regular Honite for close tolerance work or minimum removal of metal. No other barrel finishing abrasive (not even granite) keeps its edge as long.

Send today for **FREE BOOKLET**

"3M Barrel Finishing" is filled with important information on how to increase finishing efficiency.

Minnesota Mining & Mfg. Co.
Dept. PM-122 St. Paul 6, Minn.

NAME.....

COMPANY.....

ADDRESS.....

CITY.....ZONE...STATE.....

Made in U.S.A. by Minnesota Mining & Mfg. Co. General Offices: St. Paul 6, Minn. In Canada: London, Ont., Can., Export: 122 E. 42nd St., New York City. Makers of "Scotch"® Pressure-Sensitive Tapes, "Scotch"® Sound Recording Tape, "3M"® Adhesives, "Underseal"® Rubberized Coating, "Scotchlite"® Reflective Sheeting, "Safety-Walk"® Non-Slip Surfacing.

3M COMPANY

For additional information Circle No. 42 on the Reader Service Card

PROMOTIONS and APPOINTMENTS

BERESFORD N. CLARKE has been appointed sales engineer in the New England territory for *Surface Combustion Corp.*, and will be engaged in sale of special furnace heat treat equipment.

KENNETH R. BLAISDELL has been named field engineer in the Springfield, Mass., area by *The Bellows Co.*

J. W. MULL, JR. of Indianapolis, Ind., has been named sales representative for *Sintercast Corporation of America* in the Indiana, Western Ohio and Northern Kentucky territory.

ERIC O. PRANGE has been named Detroit district manager for the *Claud S. Gordon Co.* of Chicago.

GEROGE FARNHAM has joined the magnesium sales staff at the New York office of The Dow Chemical Co.

ARTHUR J. ROCKE has been appointed export manager for the *Arthur Colton Co.*, subsidiary of the Snyder Tool & Engineering Co. of Detroit.

W. B. LEWIS, JR. has been appointed West Coast sales representative of *Bohn Aluminum & Brass Corp.*

NELSON G. SPOTH has been promoted from sales manager to vice president in charge of sales of *Kolcast Industries, Inc.*, manufacturers of investment castings from frozen mercury patterns.

JACK S. BRUNDAGE has joined the New England sales and service staff of the *Organic Ccatings Div., United Chromium, Inc.*

JAMES M. McWHIRTER, formerly Southern Works Manager for *Pennsylvania Salt Mfg. Co.* has been appointed manager of the company's Wyandotte Works.

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Even when little secondary machining is involved powder metallurgy is able to compete with sand casting. .. Feb. p 74
Fuse caps of brass powder replace forgings. ---------- July p 72
Hardened powder part 28 percent less costly. ---------- Jan. p 61
Iron powder bearing retainer ring replaces part machined from wrought stock. ---------- Feb. p 73
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Porosity of powdered metal part utilized to secure good bonding of plastic. ---------- May p 75
Powder metallurgy gives comming surface with high degree of uniformity. ---------- Apr. p 110
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Uniformity from piece to piece higher with sinterings than with machined parts. ---------- Sept. p 78

For additional information Circle No. 58 on the Reader Service Card

For Your Ferrous Casting Needs Get These...

4 Freedoms

Freedom from . . .

1 Porosity
2 High Cost Material
3 Expensive Machining
4 Metallurgical Variation

with

PERMANENT MOLD Gray Iron Castings

Permanent Mold Gray Iron Castings by DOSTAL offer many advantages. Their structure is uniform and surface scale is eliminated. These 2 factors permit higher speed machining with faster feeds. The dimensional accuracy and uniformity of DOSTAL Permanent Mold Castings reduces machining operations to a minimum. Permanent molded castings are uniform in hardness and their structure is dense and porous-free.

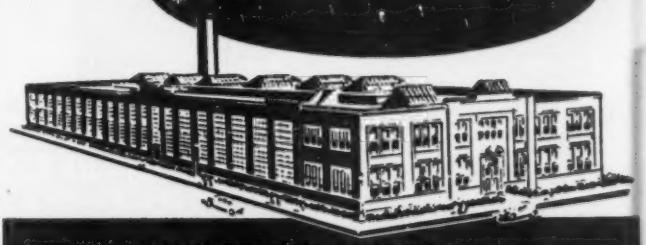
Write Us Now — Find out how you can cut the costs of your products through the use of Permanent Mold Gray Iron Castings

DOSTAL

FOUNDRY and MACHINE COMPANY
2504 Williams Drive
Box 180 Pontiac, Mich.

For additional information Circle No. 57

From One Source



A COMPLETE DIE CASTING SERVICE
. . . FROM DESIGN TO FINISHED PRODUCT.

No matter what your die casting requirements may be, Central has the facilities, the equipment, the experience and trained personnel to produce castings to meet your rigid specifications.

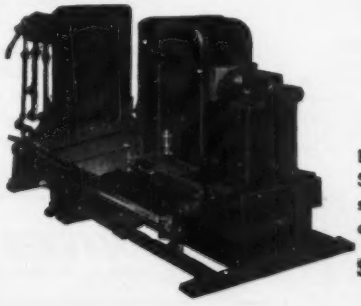
Take advantage of Central's complete facilities and be assured of prompt economical service on the best castings made.

- Complete engineering and design service
- Die and tool making
- Most modern production equipment
- Research and quality control facilities
- Machining and finishing

May we help you with your production requirements.

Write today for prompt and practical assistance

CENTRAL Die Casting & Mfg. Co.
2935 W. 47th Street • Chicago 32, Illinois



PERMANENT MOLD MACHINES

for

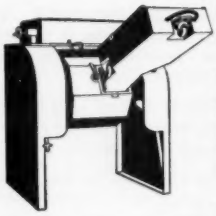
Hand, Air or Hydraulic Operation

Built to suit your requirements
Send complete specifications so we can quote prices and deliveries.

STANDARD MACHINERY CO.
Grand Rapids 4, Michigan

For additional information Circle No. 81 on the Reader Service Card

SUPER-HONITE CHIPS NEVER QUIT CUTTING!



THE LONGER THEY'RE USED, the sharper they get! "Super-Honite" Chips can't wear smooth. New cutting edges are constantly exposed as surface areas are slowly reduced.

Longer lasting, too. These improved barrel-finishing chips—composed of aluminum oxide grain with ceramic non-crystalline bonding agent—*outlast other aluminum oxide chips two to one.* And, because of their completely uniform composition, used chips can be re-graded for different finishing operations.

Try "Super-Honite" Chips on your next deburring or burnishing job. Get higher-lustre finishes at lower unit costs. Prove it to yourself.

TOUGHEST NATURAL CHIP! Use Regular Honite for close tolerance work or minimum removal of metal. No other barrel finishing abrasive (not even granite) keeps its edge as long.

Send today for **FREE BOOKLET**

"3M Barrel Finishing" is filled with important information on how to increase finishing efficiency.

Minnesota Mining & Mfg. Co.
Dept. PM-122 St. Paul 6, Minn.

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COMPANY.....

ADDRESS.....

CITY.....ZONE...STATE.....

Honite BRAND

Made in U.S.A. by Minnesota Mining & Mfg. Co. General Offices: St. Paul 6, Minn. In Canada: London, Ont., Can., Export: 122 E. 42nd St., New York City. Makers of "Scotch"® Pressure-Sensitive Tapes, "Scotch"® Sound Recording Tape, "3M"® Adhesives, "Underseal"® Rubberized Coating, "Scotchlite"® Reflective Sheeting, "Safety-Walk"® Non-Slip Surfacing.

3M COMPANY

For additional information Circle No. 42 on the Reader Service Card

PROMOTIONS and APPOINTMENTS

BERESFORD N. CLARKE has been appointed sales engineer in the New England territory for *Surface Combustion Corp.*, and will be engaged in sale of special furnace heat treat equipment.

KENNETH R. BLAISDELL has been named field engineer in the Springfield, Mass., area by *The Bellows Co.*

J. W. MULL, JR. of Indianapolis, Ind., has been named sales representative for *Sintercast Corporation of America* in the Indiana, Western Ohio and Northern Kentucky territory.

ERIC O. PRANGE has been named Detroit district manager for the *Claud S. Gordon Co.* of Chicago.

GEROGE FARNHAM has joined the magnesium sales staff at the New York office of The Dow Chemical Co.

ARTHUR J. ROCKE has been appointed export manager for the *Arthur Colton Co.*, subsidiary of the Snyder Tool & Engineering Co. of Detroit.

W. B. LEWIS, JR. has been appointed West Coast sales representative of *Bohn Aluminum & Brass Corp.*

NELSON G. SPOTH has been promoted from sales manager to vice president in charge of sales of *Kolcast Industries, Inc.*, manufacturers of investment castings from frozen mercury patterns.

JACK S. BRUNDAGE has joined the New England sales and service staff of the *Organic Coatings Div., United Chromium, Inc.*

JAMES M. McWHIRTER, formerly Southern Works Manager for *Pennsylvania Salt Mfg. Co.* has been appointed manager of the company's Wyandotte Works.

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Die castings give light weight, weather-proof housing. ..... Mar. p 70
Die casting reduces waste and expensive machining on blind cylinder. Oct. p 98
Die cast ball now replaces plastic on tractor shift lever. ..... Sept. p 78
Die cast switch component replaces two piece stamped assembly. ..... Sept. p 78
High ductility of zinc die casting alloys their use as rivets. ..... Feb. p 73
Internal threads cast into die cast nut. ..... Jan. p 61
Pipe plugs as aluminum die castings. Nov. p 65
Pressure tight aluminum die casting requires no sealing — has extra close tolerances. ..... July p 72
Special nut die cast in aluminum — needs only threading to finish. ..... Apr. p 109
Yellow brass pump impellor is die cast. ..... July p 71
Zinc die casting replaces brass screw machine part. ..... Apr. p 110

Investment Casting

All assembly operations on surgical tweezers eliminated through use of investment casting. ..... Oct. p 97
Corrosion and oxidation resistant thermo-couple protection tubes successfully investment cast. ..... Mar. p 69
Eight pounds of SAE 4140 steel saved per unit by investment casting. Jan. p 61
Investment cast radar fitting needs no machining. ..... June p 75
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Investment casting solves difficult procurement problem on radar pieces. .. Feb. p 74

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Permanent Mold Castings

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Chromium plated zinc die castings and permanent mold castings produce household and restaurant equipment. ..... May p 75
Combination of electrical and mechanical properties in brass permanent mold casting. ..... June p 75
Even with limited quantities and considerable secondary machining, permanent mold casting is economical. ..... Mar. p 70
Permanent mold cast blank used to machine bushing. ..... Jan. p 62

Plaster Mold Castings

High yield strength castings manganese bronze by plaster mold casting. Jan. p 62
Plaster mold meets engineering demands. ..... Nov. p 65
Smooth, readily cleaned surface secured by plaster mold casting. .. Apr. p 110

Powder Metallurgy

Alloy mixtures non-miscible in liquid state produced by powder metallurgy. ..... May p 75
Brass powder makes suction cup for egg crate manufacture. ..... Apr. p 109
Combination gear and cam produced by powder metallurgy. ..... Jan. p 62
Cost reduction with nickel-silver sintering. ..... Nov. p 65

For additional information Circle No. 60 on the Reader Service Card

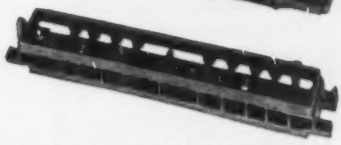
Castings by HAMPDEN

(NON—FERROUS)

PERMANENT MOLD, SAND, DIE CASTINGS

Our die casting division products require a minimum machining. Let our engineers solve your quantity production problems at attractive prices consistent with high quality.

FAMOUS PERKINS BRAILLER and some of the intricate parts die cast at HAMPDEN.



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HAMPDEN BRASS & ALUMINUM CO.

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What MILWAUKEE'S New Plant Offers You

. . . every Facility for Complete Die Casting Service to Help You Make a Better Product

The experience and knowledge gained in helping others realize the full benefit of the die casting process . . . for more than 40 years . . . is a Plus Value for all MILWAUKEE customers. Coupled with the modern facilities of MILWAUKEE'S new plant, it can help you produce a better product, with greater sales potential, at a lower net cost.

We operate under the Certified Zinc Plan of the American Die Casting Institute, Inc.

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4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN

Established 1909

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1. Porosity
2. High Cost Material
3. Expensive Machining
4. Metallurgical Variation

with

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DOSTAL

FOUNDRY and MACHINE COMPANY
2504 Williams Drive
Box 180 Pontiac, Mich.

For additional information Circle No. 57

EDITORIAL INDEX—continued

Combination of powdered metal gear and nylon cam gives inexpensive assembly. ---------- Apr. p 109

Copper infiltrated sintering has improved wear and impact properties. -- Oct. p 97

Elimination of high scrap losses due to machining is one advantage of powder metallurgy. ---------- Mar. p 69

Even when little secondary machining is involved powder metallurgy is able to compete with sand casting. -- Feb. p 74

Fuse caps of brass powder replace forgings. ---------- July p 72

Hardened powder part 28 percent less costly. ---------- Jan. p 61

Iron powder bearing retainer ring replaces part machined from wrought stock. ---------- Feb. p 73

Nickel silver sintering used to replace fully machined aluminum part. -- July p 71

One piece porous bronze replaces four parts on thrust bearing ---- July p 71

Porosity of powdered metal part utilized to secure good bonding of plastic. ---------- May p 75

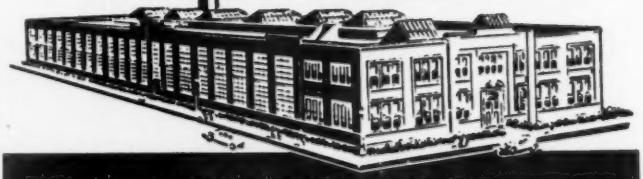
Powder metallurgy gives camming surface with high degree of uniformity. ---------- Apr. p 110

Sinterings produced in a wide variety of complex shapes. ---------- Oct. p 98

Uniformity from piece to piece higher with sinterings than with machined parts. ---------- Sept. p 78

For additional information Circle No. 58 on the Reader Service Card

From One Source



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Take advantage of Central's complete facilities and be assured of prompt, economical service on the best castings made.

- Complete engineering and design service
- Die and tool making
- Most modern production equipment
- Research and quality control facilities
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May we help you with your production requirements.

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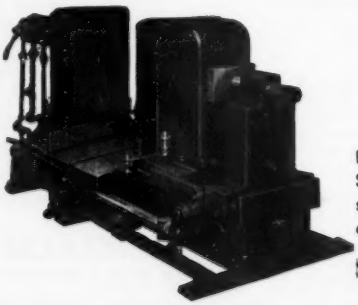

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Built to suit your requirements
Send complete specifications so we can quote prices and deliveries.

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Grand Rapids 4, Michigan

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DIE CASTING ANALYSIS
continued from page 41

test casting, a prototype aluminum alloy test casting, assumed to be produced under equal thermal conditions with four different gate thickness on eleven different die casting machines.

The results of the analysis led to the following conclusions:

1. Satisfactory die castings (from the viewpoint of surface quality, sharpness of outline and porosity) can be produced on all types of die casting machines provided thermal conditions, venting factor, gate and vent areas are properly coordinated with the characteristics of the particular machine and metal system.

2. The optimum gate thickness for minimum porosity can be calculated.

3. Small deviations from the optimum gate thickness will bring about a pronounced increase of porosity of castings in the case of direct air gooseneck machines. Hydraulically driven cold and hot chamber plunger type machines are much less sensitive in this respect.

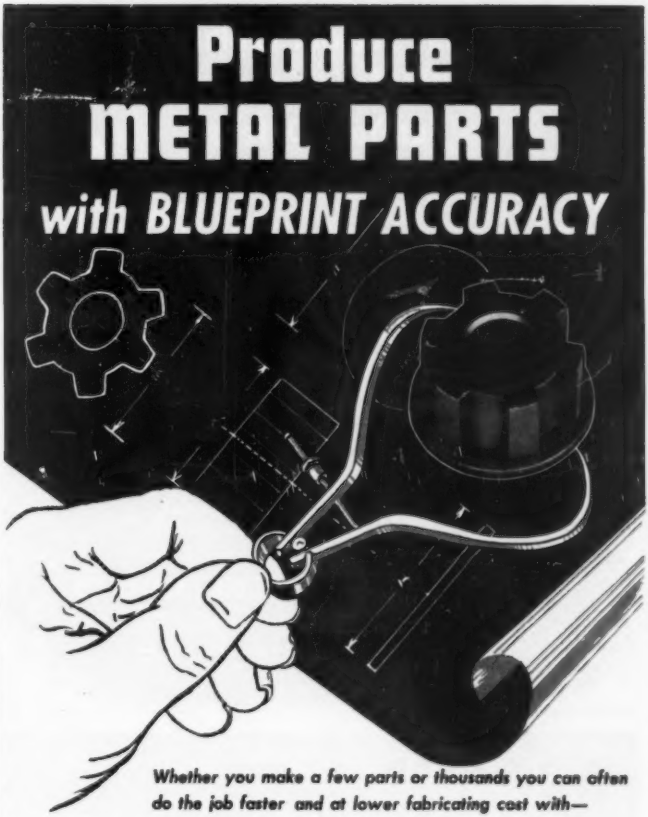
4. The metal pressure and velocity and the die filling time can be calculated in terms of the machine and metal system characteristics accumulator or tank pressure, accumulator factor, and cavity air pressure factor which includes the venting factor.

5. Further research work to obtain solidification data is desirable.

The theoretical approach presented in this study was partially verified by calculating the metal velocity for the condition of the Koester and Goehring[1] set-up. These authors devised an

continued next page

[1]Koester, Werner and Karl Goehring, "Ueber den Einstroem - und Fuellvorgang bei Spritzguss an Hand kinematographischer Aufnahmen," Die Giesserei, Heft 26 (26. Dezember 1941).



Whether you make a few parts or thousands you can often do the job faster and at lower fabricating cost with—

METAL POWDERS

Here's Why! Powder Metallurgy is speedy and accurate. Parts may be so pressed and sintered that many machinings and other production operations are eliminated or simplified. Parts can be produced to close tolerances.

Powder metal parts are economical. There's no waste metal. Unused powder after pressing can be used again.

SAVE TIME—SAVE COSTS

MD Metal Powders are dependable because they are the result of over 35 years of research and manufacture by MD, the pioneer in metal powder development.

Consult MD for thoroughly experienced advice and names of recognized qualified molders.

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Elizabeth B • New Jersey

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Plants:
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SUBSIDIARY OF AMERICAN-MARIETTA COMPANY

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WORLD'S LARGEST MANUFACTURER OF FINELY DIVIDED METALS

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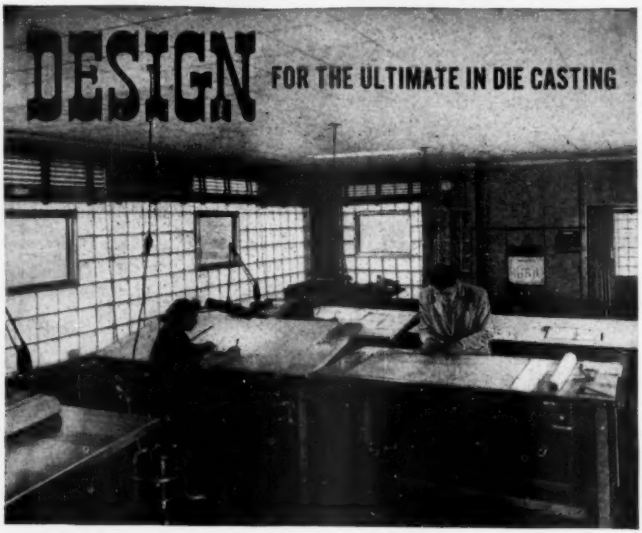

We offer every customer competent engineering assistance in product design. This service assures you lowest tooling cost, flexibility of production . . . highest quality at lowest cost.

THE NEW ENGLAND DIE CASTING CO.

445 Front Avenue West Haven, Conn.

For additional information Circle No. 64 on the Reader Service Card

arrangement to measure experimentally the steady state velocity of a free jet which emerges from the machine nozzle of a small plunger type (hot chamber) die casting machine. The agreement was found to be between 2 - 4.5%.

OPPORTUNITIES

SALES ENGINEERING representation: New York to Washington; competent, comprehensive, unique & effectual. Get set to get your share - or more - of America's largest non-armament, incipient industrial market centering on Morrisville steel. Write Box No. 12152, Precision Metal Molding.

WELL ESTABLISHED MANUFACTURER'S AGENT covering southwestern Ohio area would like source producing precision investment castings; also source of aluminum sand & permanent mold castings. Now contacting industries in this area which are users of these products. Write Box No. 12252, Precision Metal Molding.

POWDER METALLURGIST WANTED with sufficient background & experience to initiate & operate new powder metal department. Excellent chance to advance in expanding organization. Research & development of new products, processes & materials is desired. Salary adequate & dependant on background, experience & responsibility carried. Write Box No. 12352, Precison Metal Molding.

FOR SALE: BA-12 Kux die casting machine; die space between bars 12¼" x 12¼"; four to six lbs. per shot; brand new, never used for production.

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FOR SALE: 1 new, never used DCMT die casting machine A 16 A 218 air operated, 1 lb. shot, with Partlow Thermostatic controls; with die blocks. 1 American Gas Furnace, Model 345 A, 3000 lb., with Leiman Bros. Air Pump, D, and with automatic temperature control. Write Box No. 12452, Precision Metal Molding.

continued next page

EXPERIENCED casting salesman with established clientele desires to represent a high calibre die casting company in the Midwest area. Write Box No. 12552, Precision Metal Molding.

ELECTROLYTIC IRON POWDER 24% OVER 1951

The sale of electrolytic iron powder by the Plastic Metals Division of The National Radiator Co., Johnstown, Pa., during the quarter ending September 30 was up 24 percent over that for the same quarter of last year. A large part of the increase is attributed to higher demand for electrolytic iron powder by the compacting and electronic industries, according to B. T. duPont, sales manager of the division. An increase of about 8 percent was experienced in the sale of non-ferrous metal powders produced by Plastic Metals during the quarter just ended.

ASR asked

Where to get a small handle button, wear-and-water-resistant . . . light enough to be set in plastic . . . produced in large quantities, quickly and inexpensively?

GRC* answered

Tiny GRC precision zinc die castings will make ideal handle buttons for the new Gem razor . . . meet to a T every ASR specification.

ASR's GEM American Safety Razor's new Feather Weight Gem Razor weighing only 1 1/10 oz.

* WITH GRC TINY PRECISION ZINC DIE CASTINGS

If obtaining really small parts speedily and economically is your problem, too, why not let GRC tackle it? Gries revolutionary, high speed, mass production methods are geared to turn out simple or intricate parts in one operation. Trimmed, ready for use . . . GRC zinc die castings as small as .000004 of a lb. in lots from 100,000 to millions . . . at a price to help you produce at a profit! Remember . . . it's GRC for smallness unlimited.

Write Today for Bulletin and Actual Part Samples

GRIES REPRODUCER CORP.

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MAX. WT.—1/3 OZ.
MAX. LGTH.—1 3/16"
SMALLNESS UNLIMITED

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ZINC OR ALUMINUM die castings of highest quality produced on modern, fast equipment. Guaranteed satisfaction. Prompt service.

Inquiries Invited

Tell us your needs. Send blueprints or drawings for quotation. No obligation, of course.

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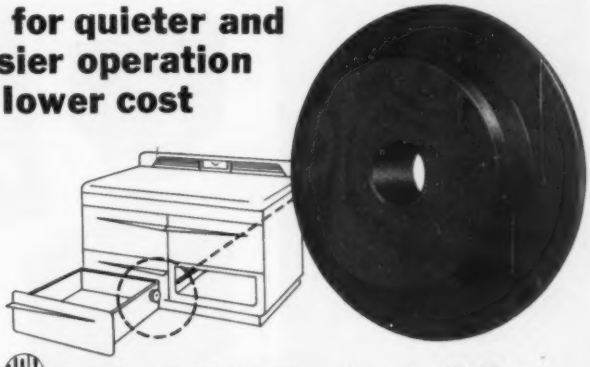
... for quieter and easier operation at lower cost



IPM Powdered Metal Stove Drawer Rollers

IPM Powdered Metal Stove Drawer Rollers molded in powdered iron and oil impregnated for life time lubrication provide a smoother, less noisy stove drawer operation at lower cost. They are heat resistant, non-deforming, have great strength and excellent wear resistant qualities. Here's only one of many examples of how IPM powdered metal parts are helping manufacturers to reduce costs and overcome production headaches. Perhaps this example will suggest some use for IPM powdered metal parts in your product. If so, write us for further details.

The Powder Metallurgy Engineers Handbook is now available — ask for a copy on your company's letterhead.

IPM International Powder Metallurgy Co.
439 W. MAIN STREET • RIDGWAY, PENNSYLVANIA

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DIE CASTINGS by Stewart

42 years of service to Industry!

Designing
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Engineering
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Die Making
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Metallurgical Control
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Most modern Die Casting Equipment
•
Complete machining, polishing and assembly facilities

We invite inquiries concerning all Die Casting problems

STEWART DIE CASTING
Division of
Stewart-Warner Corporation
4535 Fullerton Ave., Chicago 39, Ill.
275 Warren St., Bridgeport, Conn.

For additional information Circle No. 65

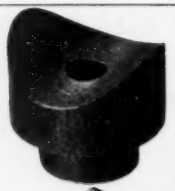
FOUR FIRMS LICENSED

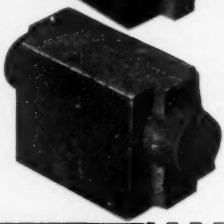
Wider application in America and Europe of the Al-Fin process — successful method of joining aluminum and its alloys to steel and cast iron, or to nickel and titanium — has been indicated with the announcement that two additional firms in this country and two abroad have been licensed to use the manufacturing technique by the Al-Fin Division of the Fairchild Engine and Airplane Corp.

This brings to 18 the number of companies licensed by Al-Fin, according to M. V. Little, assistant general manager of the division. He stated that the latest licensing agreements have been signed with Thompson Products, Inc., Cleveland and St. Catherine's Ontario, Canada; National Steel and Shipbuilding Corporation, San Diego; Establishments J. Floquet. Courbevoie (Seine), France, and W. & W. Schenk, Maulbronn, Germany.

For additional information Circle No. 77

DIE CASTINGS
ALUMINUM OR ZINC
☆
C. M. GREY MFG. CO.
QUALITY PRODUCTS SINCE 1910
SEND BLUEPRINTS OR SAMPLES FOR QUOTATIONS
358 CENTRAL AVENUE
EAST ORANGE, N. J.





Precision Made... For Precision Performance

POWDERED METAL PARTS

precision made from exclusively formulated non-ferrous Sintroloy and Ductiloy are molded to close tolerances, thereby eliminating machining of intricate shape and high scrap loss.

Perhaps we may be able to help you solve specific parts problems. Get in touch with National Molded today for prompt attention.

Write today for detailed information and free literature on cost-saving standard bearings which are available from stock.

NATIONAL MOLDED PRODUCTS, INC.
1942 MILL ST. • ST. MARYS, PA.

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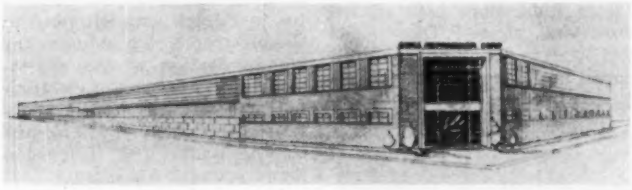
PMM INDUSTRY NEWS

GRIES REPRODUCER BUILDS NEW PLANT



Ground has been broken on a 3-acre site in New Rochelle, N. Y., and plans are proceeding for the construction of a modern plant with 90,000 square feet of floor space, it has been announced by Gries Reproducer Corp. A fully equipped one and two-story building of steel frame and brick design will cover about two acres, to be completed early next year.

Gries is known for the design and building of precision instruments, special machinery and tools, as well as the manufacture of a tremendous number of very small die-cast zinc parts and special tiny molded plastic parts. In business for 30 years, Gries is a major producer of small zinc die castings and metal products such as wing nuts, tubular rivets, cap nuts, gears and pinions, cup hooks, drapery rings, and "intercast" multiple parts units.

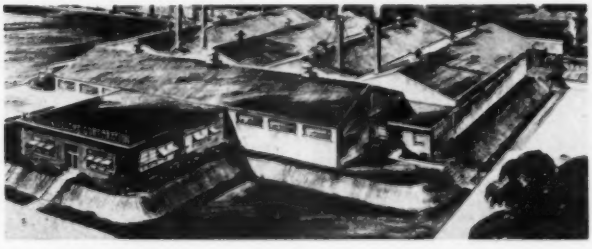
The corporation will continue operating at 133rd St. and Willow Avenue, The Bronx, N. Y., until the new site is ready for occupancy.

AMERICAN ALLOYS NEW MIDWEST SMELTER

American Alloys Corporation, new aluminum smelter, has opened the first two wings of its facilities for full production in the northeastern industrial section of Kansas City, Mo. Architect's drawing of the plant is shown below.

The smelter is equipped with modern smelting and refining equipment and has complete spectrographic, photometric and chemical lab equipment. The corporation produces primary and secondary aluminum alloys and "AmAlloy", a new high-strength aluminum-magnesium alloy.

Officials of American Alloys are: Thomas E. Kramer, general manager; John A. Benson, manager of remelt ingot sales; Wm. A. McKnight, director of scrap purchases and in charge of plant production. All are experienced in the aluminum smelting industry.



REORGANIZE METALS UNITS OF NPA

Reorganization of two divisions of the National Production Authority, U. S. Department of Commerce, has been announced.

Under the new set-up, the Tin Lead and Zinc Division is combined with the Miscellaneous Metals and Minerals Division, with Erwin Vogelsang named as director of the new division. Harry Sharpe will remain as deputy director.

Mr. Vogelsang, was director of the Tin, Lead and Zinc Division of the War Production Board during World War II.

NEW ALLOY PRECISION V. P.

Appointment of Ronald D. Gumbert as executive vice president of Alloy Precision Castings Co., has been announced by S. J. Sindeband, company president. Before joining the Cleveland firm which manufactures Mercastings from frozen mercury patterns, Mr. Gumbert was production superintendent at the Pittsburgh plant of Armstrong Cork Co.

SEELIG JOINS CHROMALLOY

Richard Seelig, formerly vice president of American Electro Metal Corp., has been named executive vice president of Chromalloy Corp., 109 W. 64th St., New York City. This company operates under a patented chromizing process to provide low carbon, high carbon, low alloy and cast steel parts with resistance to oxidation and corrosion similar to that of high chromium stainless steels.

ELECTRONIC IRON CORE DIMENSIONS STANDARDIZED

All of the types of electronic cores made from iron powder and commonly in use by the radio and television industry have been listed in a new Standard just revised by the Metal Powder Association. First released in 1950 as tentative, the Standard has now been brought up to date and re-issued with the designation 11-52T, "Electronic Iron Core Preferred Dimensional Specifications."

As revised the Standard defines the terms commonly associated with electronic cores made from powdered magnetic materials and specifies the preferred dimensions of standard sizes and shapes. Dimensions are listed in detail for plain iron cores, insert iron cores, threaded iron cores, tuning cores and sleeve iron cores. In addition to diameters and lengths, data is provided for concentricity, screw driver slot dimensions, hexagonal hole sizes as well as threaded spring type and spaded insert sizes.

The Standard was developed by the members of the Electronic Core Standards Subcommittee to meet a long-felt need in the electronic core industry for standardization of the dimensions and tolerances of electronic cores and reflects, in substance, the practices established by the Radio and Television Manufacturers Association.

William E. Cairnes, president of Radio Cores, Inc., is chairman of the Subcommittee.

Copies of the new Standard and other Standards published by the Metal Powder Association may be obtained for 25c per copy by writing to the Association at 420 Lexington Ave., New York 17, N. Y.

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BUSINESS MACHINES
continued from page 46

competitive in cost with the sinterings.

However, the real value of powder metallurgy to turn out a small, detailed piece that is the full equivalent of a screw machine piece and competitive in cost should not be overlooked. The powder metallurgy tools are in standby condition and will undoubtedly come into use later on to take some of the screw machine load.

One important advantage which the sintering has over the screw machine anchor nuts is the saving of metal. The screw machine produces nearly 50 percent chips, whereas powder metallurgy is distinguished by complete freedom from scrap.

Bearings - standard and special

Among the many sinterings used by Monroe Calculating Machine Company, but not

shown here, are innumerable bearings, some of them having special shapes which were previously turned on automatic screw machine. Better uniformity, lowered scrap losses and saving in machine time are important advantages of these porous type bearings.

One special formulation of brass powder has been introduced by Bound Brook Oil-less Bearing Company who produce many of these bearings for Monroe. This formulation is intended for bearings which require a staking or riveting operation. An example of this is a tubular bearing which is pressed through a hole in a sheet and then is staked over to lock it in position.

Sinterings having sufficient ductility for ordinary cold-forming operations such as these, have replaced many heavily machined bearings formerly produced from free cutting brass bar.

The application of sinterings in Monroe Calculating Machines is still in its early stages. Much development work remains to be done, and many applications now undergoing service testing will reach regular production lines in the near future. As powder metallurgy develops new techniques and makes possible new shapes and increased physical properties, many other machine parts may be redesigned for this process.

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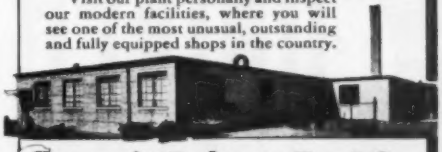

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PEROXYGEN COMPOUNDS
continued from page 56

oxide to be used is rather critical and depends on the particular treating bath used. Satisfactory coatings require, e.g., a phosphoric acid solution with a zinc content of about 0.25 percent and not under 0.1 percent nor over 0.5 percent with hydrogen peroxide present in the solution in amounts between 0.004 percent and 0.024 percent, and further containing enough sodium hydroxide to obtain a pH of about 3, the treatment being carried out at below 130 F[17].

The principle illustrated by these examples may be applicable to many other cases, although modifications will be necessary to fit various operating conditions.

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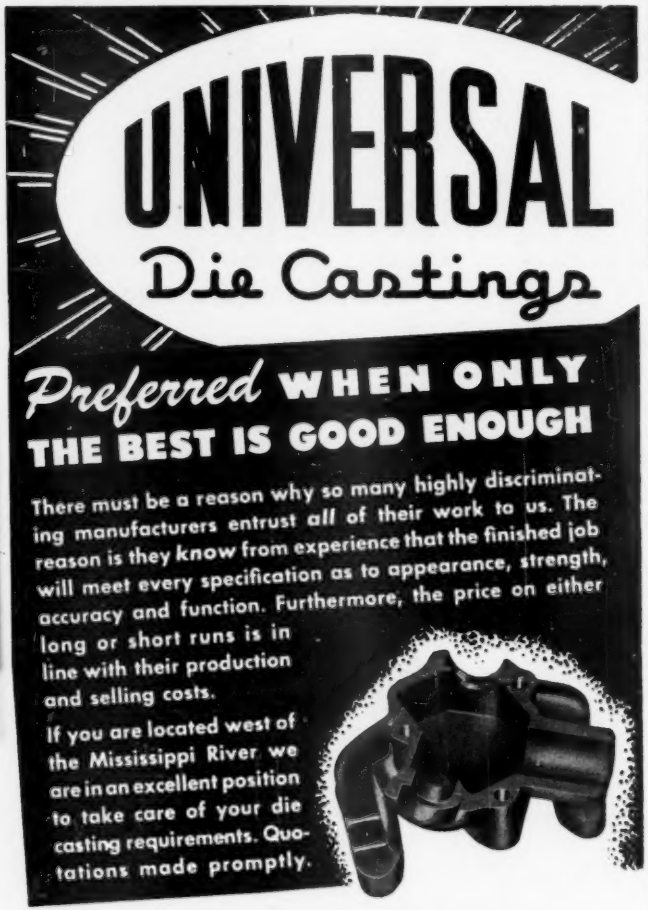
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ELECTRODEPOSITION
continued from page 43

This surface is rendered conducting by coating with silver.

In Type No. 2, the mandrels are usually stainless steel, invar, nickel or the like. They are machined to size and the surface oxidized by chemical action to present a hard, conducting surface. The electroform and mandrel are separated by heating under oil and drawing. In some cases, especially where aluminum is used, freezing temperatures are required in order to obtain a wider range to allow a greater difference in coefficient of expansion, permitting greater ease of separation.

Expendible mandrels are made from low melting alloys, plastics, waxes or dissolvable

metals. This type of mandrel is used where the piece does not have a straight draw, undercuts are present, or the mandrel changes shape during removal. Where a low melting alloy is used, separation is made with heat and the metal recovered and can be reused. Aluminum can be used and is dissolved in sodium hydroxide, or zinc which is soluble in hydrochloric acid.

In general, three metals, namely nickel, copper and iron are now commercially electroformed on a wide scale. Each has its individual properties, and applications, and especially nickel and copper are adaptable to mass production. Chromium and silver are used as a finish where surfaces of high resistance to abrasion and corrosion or high electric conductivity properties are required.

Table 1
Typical Formula for Electroforming

Single nickel salt	50 ounces per gallon.
Nickel chloride	8 ounces per gallon.
Boric acid	6 ounces per gallon.
Anti-pitting agent	Hydrogen peroxide
Stress Relief	Saccharine.
Brightener	Sulphonamides.
Anodes	Rolled, annealed, carbonized.
Temperature	130 F - 140 F.
Current density	40 - 80 amperes per sq. ft.
PH	3.0-4.0
Surface tension	35-40 dynes/cm.
Agitation	In two planes.
Filtration	Constant.
Hardness	40 Rockwell C.
Elongation	20% in two inches.
Tensile strength	100,000 psi.
Corrosion resistance	Excellent.
Density in pounds per cubic foot	553.
Thermal coefficient of linear expansion per degree F	.05566.
Thermal conductivity, BTU per hour per sq. ft. per degree F per inch	468 at 32 F.

The major portion of our products center around nickel. A typical formula with operating conditions and properties is offered in Table 1.

Some products fabricated by electroforming are precision seamless tubing, radar and microwave components, float switches, venturi, nozzles, record masters, surface roughness standards, computing mechanisms, printing plates, reflectors, pitot-static tubes, propellor blades, metallized plastics, band instruments, and low pressure laminate molds.

Figure 1 shows our line of "precision holes", which in reality are precision seamless tubes. These tubes are not limited to cylindrical sections, but can be square, rectangular, hexagonal, ellyptical and fluted. Lengthwise, such tubes can be tapered and have internal shoulders or steps. The length of this tubing is usually less than three feet, although there is no limitation in the process to prevent making longer units.

An example of the use of such precision tubing is in a pressure switch for jet engines where a tolerance requirement is concentricity of plus or minus .0002 total indicator reading between ID and OD, and where the part must be non-corrosive due to exhaust gases. It is essential that the part should have a 5 RMS inside finish and be cap-

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able of withstanding temperatures of 500 F.

Another example of the assembly of this type precision tubing is in a float switch designed for use in liquid oxygen to withstand a thermal shock of of -200 F. In this case, weight was an important factor. A switch fabricated from aluminum weighed 36 grams when one assembled to meet specifications and electroformed in nickel weighed 15 grams.

The process further applies to seamless tube constructions for instrumentation and flow control covering such products as very accurate venturi, flow control units, and non-corrosive spray nozzles. It is possible to obtain accuracy heretofore impossible where small internal diameters are required. Other parts are used in gas meters, refrigeration units, ejectors, and all types of control mechanisms.

The manufacturing techniques now established for electroforming of metals, lend themselves to the mass production of complicated shapes such as microwave components. Furthermore, the process brings forward for the first time the electroforming of flanges in position. This process eliminates the costly and injurious steps of brazing. In the components illustrated in Figure 2 the flanges and iris plates with inserts are assembled to the pattern constructions and all electroformed in place

Engineers appreciate that good design practice requires inside surfaces of microwave components must be smooth, have no surface breaks, and held to close tolerances. It is of paramount importance to prevent reflections and excessive absorption of energy in the thin conductive surface layer. A polished surface of proper conductive metal free from minute variations is desirable. By electroforming flanges in place, the distortion normally associated with brazing is eliminated.

Costs on electroformed products have been drastically reduced and a steady flow of production can now be realized. This is accomplished in microwave components through

1. Faster rate of deposition,
2. Steady flow of parts,
3. Improved pattern techniques,
4. Improved mounting procedures, permitting more parts in process,
5. Closer inspection permits fewer rejections,
6. Adoption of vapor blast cleaning of electroform,
7. Electroforming flanges in position eliminates brazing, thereby greatly reducing machining time.

In designing a part to be fabricated by electroforming, the engineer should take advantage of the method's special characteristics. In this way, a better product is made at lower cost.

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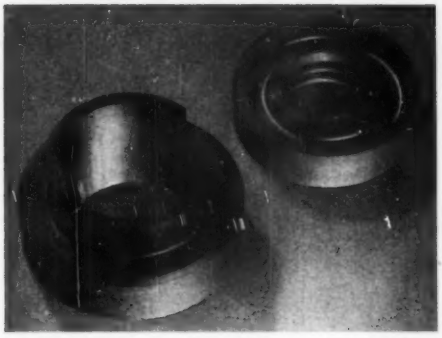
SIMPLIFIED SOLUTIONS

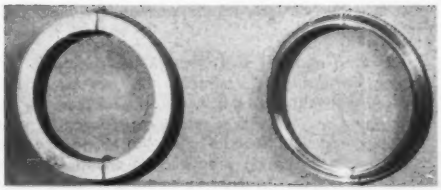
for production problems



THE CHANGE IN SURFACE CONTOUR that can be accomplished by powder metallurgical techniques is almost limitless as long as variations of surface are at right angles to the direction of press movement. Two good examples of this flexibility are shown, left. Both parts are iron sinterings made by the Presmet Co. of Worcester, Mass. for use on textile machines. The waste of metal and the time consumed by making the parts of wrought metal are at once apparent. As sand casting they required machining all over and presented a difficult job at best. Rejects were always high due to blow holes and porosity uncovered during machining. The two annular grooves on the one piece are ,of course, machined in after forming and sintering. A plus of powder metallurgy comes in the self lubricating properties of the parts aftey they have been impregnated with oil.

WHERE LIGHT WEIGHT, moderate precision, low cost and rigidity are required an aluminum permanent mold casting such as the one shown, right, can often be used advantageously.

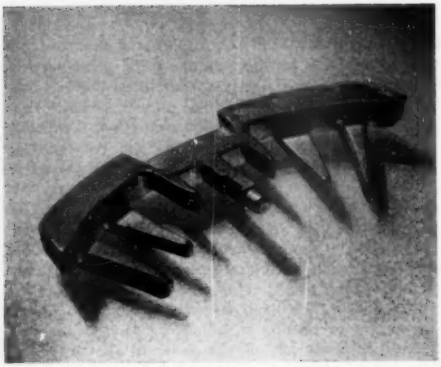
This casting is used to connect and at the same time hold in precise position and alignment a pump and motor. Since the number of parts used is relatively small the high cost of die casting dies could not be justified but permanent mold dies could be economically made and used. Even though several secondary machining operations are necessary, the greater accuracy of a permanent mold casting enabled easier and faster chucking with less metal removal necessary; fewer rejects are found in the permanent mold casting than would be found in sand castings.



FASTER DELIVERY due to elimination of precision machining operatons resulted when The Lionel Corp. changed from machined bar stock to a brass sintering for the compass bezel ring for the Navy, left. Because the 120 peripheral serrations can be formed in pressing, a precision machining job has been eliminated. The piece is shown as pressed from brass powder and as finish machined. Lower tooling cost is reported.

SIMPLIFIED SOLUTIONS

for production problems

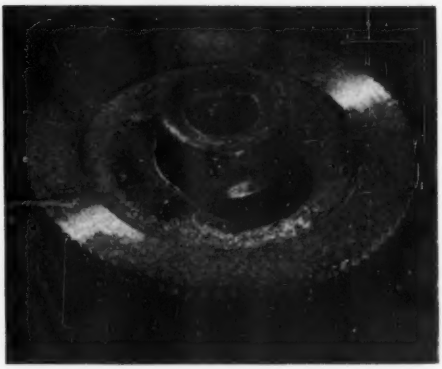


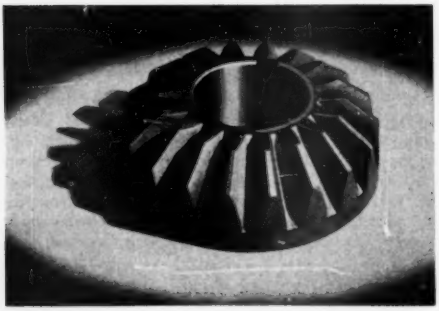
RIGIDITY, accuracy of shape and smooth surfaces are the three basic requirements for coil winding preforms, left. Given these characteristics a preform or mandrel can be used to wind, varnish, and tape coils for motors and generators so that production costs can be lowered.

The three requirements of a preform are easily and inexpensively met by using investment casting as the means of fabricating. The coil winder shown is cast in stainless steel by the Electronicast Co. of Chicago, Ill. No finish machining except to remove a minor amount of burr is required prior to putting the part into service.

PARTS WHICH RUN INTO LARGE VOLUME and require only medium dimensional accuracy are the ones which have built the die casting industry. Such a part is shown, right, where every detail except to drill and tap a hole for a set screw can be incorporated into a single casting.

As a portion of the control mechanism on a radio set, the normal easily met tolerances of the foundry are adequately close, a single piece replaces an assembly of two or more pieces, and over all rigidity is greatly increased. All this at a reduction of over 50 percent in manufacturing cost. The gear shown is typical of many used by radio manufacturers and in this particular case is made by the Springfield Die Casting Co. of Kenilworth, N. J.





BEVEL GEARS produced from metal powders are competitive in every respect with similar gears hobbed by machine. The bevel gear shown left is an example of a sintered bevel gear produced from iron or steel powders by Michigan Powdered Metal Products, Inc., of Northville, Mich.

Wearing qualities and strength are excellent, and where hardening is desirable, this can be accomplished. In addition, this type of gear can be impregnated with oil with a resulting reduction in noise, as compared with hobbed gears. At the present time, these gears are being produced on contract to meet specifications and are not inventoried as stock items.

DU-WEL METAL PRODUCTS HAS SALES MEETING

Du-Wel Metal Products, Inc., held their annual sales meeting at their factory in Bangor, Mich., on October 18. Ted Bator, president, and David Walton, vice president, discussed growth of the company and presented plans for future.

Sales representatives attending included Richard Dassex and Roy Williamson, Illinois; Fred Stork, Ohio; C. W. Ryerson, G. S. Gove, R. M. Richardson and J. B. O'Brien, Michigan; and J. L. Ball, Indiana. Seven other representatives were unable to attend.

W. R. CULBERTSON DIES

William Ray Culbertson, a vice president of Rust Furnace Co., Pittsburgh, Pa., died at his home October 29, 1952. Mr. Culbertson, 62, came to Rust Furnace Co., a subsidiary of Rust Engineering, as general manager in 1932 and was elected a vice president in 1945.

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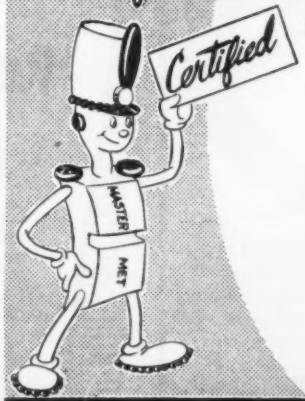

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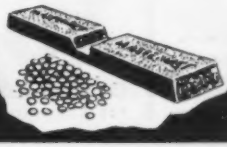

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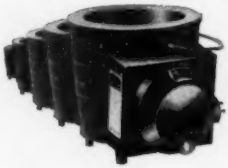

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AIRCRAFT INVESTMENT CASTINGS
continued from page 31

Step 11. Sample castings are produced in the required grade, some in the lot are destructively tested for internal soundness, heat treated to specifications, magnaflux inspected and checked for dimensional conformance to drawing. If found satisfactory in all respects, the samples are submitted to Republic for approval.

Step 12. Upon receipt of sample castings at Republic, they are routed to the Receiving Inspection Dept. where a complete dimensional layout of the samples are made. A discrepancy report is then written on each part and turned over to the Procurement Dept. When no discrepancies exist, Procurement will advise the vendor the parts are satisfactory and that production of castings can proceed. When discrepancies do exist, inspection will first submit the report to Engineering for disposition. After Engineering

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disposition has been obtained, Inspection forwards this report to procurement, who in turn will advise the vendor of the action to be taken.

Step 13. In the production of aircraft quality investment castings the metallurgical quality control procedure is of utmost importance. At Crucible, investment castings are usually made from 50-pound induction heats. The melting charge consists of bar stock and revert castings, including sprue stock from previous lots of known satisfactory analysis. A series of approximately eight or less induction heats successively cast from the same furnace on the same day constitutes one lot.

On the first of the eight heats, a complete chemical analysis is obtained; this applies to all grades cast regardless of the type of alloy. In the case of the low alloy steels, tool steels and hardenable stainless steels, the following "hardenability" control procedure is used to insure that individual heats within a lot will respond to heat treatment in a similar manner to the first heat in the lot, the composition of which is known on each individual heat in the lot a "hardenability" test specimen is cast and is hardened from the same heat treating temperature range that is used for the castings.

The hardnesses of these individual test specimens are examined, and if they fall within the previous established range for this analysis, the eight individual heats are combined into a single lot which is designated by a lot number corresponding to the heat number of the first heat; if any heat deviates from standard in the hardenability test, it is kept separate and a check analysis is run. In the case of hardenable stainless grades, the ground surface of these same hardenability test specimens is also checked for corrosion resistance by a standard copper-sulfate spot test.

The hardenable straight chrome stainless grades are, of course, resistant to this spot test, and if any individual heat fails to meet this requirement, it is also kept separate and a check analysis is run.

When tensile test requirements are specified, a set of ¼" dia. cast test bars is made from the first heat of the lot, on which the chemical analysis was obtained. Other types of test specimens, such as bend test or embrittlement test pieces are likewise cast from this first heat, if required by specification.

The castings themselves are heat treated in groups of a hundred or more pieces in small electric furnaces. Their identity by lots is maintained. Hardness checks are made on

continued next page

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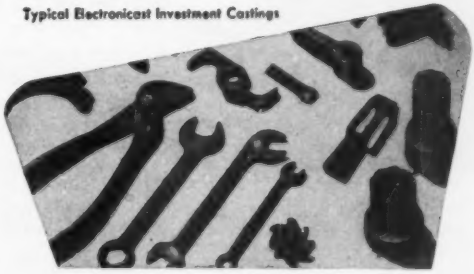
Typical Electronicast Investment Castings



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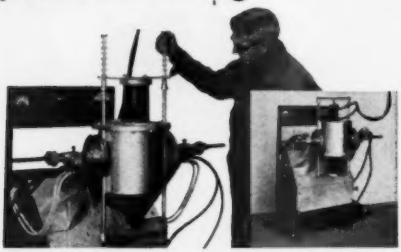

Melting position *Casting position*

The new, type IC, 12 kw., 10-lb. Detroit Electric Furnace melts and pours heats of chrome-nickel, Stellite or superalloy steels in 9-12 minutes. Casting is done by inverting the furnace, pouring directly into the investment mold which is held in place by air pressure. Melting by fast, controlled, indirect arc minimizes carbon pickup and alloy variation. Simple, efficient operation is ideal for high production of precision castings.

Write for complete information.

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each heat treating charge and the hardness range is kept within the corresponding specified limits of tensile strength. Tensile test bars corresponding to the lot are heat treated by the same procedure as the castings. This heat treating equipment must be approved for the heat treating of aircraft precision investment castings by the local regional office of the Air Force Procurement.

With this procedure, a single lot number corresponds to not more than 150 pounds of castings. If tensile bars are required by the customer, the first shipment of castings from a lot contains two machined tensile bars marked with the lot number. Subsequent shipments from the same lot will not contain tensile bars. Each individual casting is ink-stamped with the lot number. A packing slip, included with each shipment, contains the lot number and a statement that this lot has either been previously certified or a certification is to follow. A certified analysis from showing the chemical analysis corresponding

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with the lot number and the mechanical properties obtained is forwarded at the time that the first shipment from this lot is made.

Aircraft investment castings after heat treatment are magnaflux inspected. Standards of acceptance are carefully determined by interchange of information with customer's magnetic inspection department.

For dimensional control special gauges are made to check each critical dimension on the drawing on every casting to make certain that it is within tolerance. Non-critical dimensions are spot checked by standard gauging methods.

Step 14. In the case of production castings at Republic, the Receiving Inspection Department will spot check one casting of the lot received for dimensional conformity and visually inspect the balance.

All aircraft structural castings are subjected to radiographic inspection and must conform to the minimum requirements of Military Specification MIL-I-6865 and Army Air Forces Specification No. 11357 for Radiographic Inspection. Although the two parts illustrated here happen to be Class B castings, many of the structural castings produced are in the class A category.

Class A Castings

Radiographic acceptance standards are set up on all Class A structural castings as follows:

A minimum of 100 castings from the first production run, or the entire lot if less than 100 castings are received, must be X-ray inspected. The three worst acceptable castings are then chosen from this lot. These castings are machined and statically tested to destruction in a manner simulating actual conditions encountered in service. If these statically tested castings satisfactorily meet the minimum structural design requirements, the X-rays of these three castings are then used as criteria for acceptance of all future production castings of the corresponding part number. Class A castings are then subdivided into three classes according to the ratio between the ultimate actual test load and the ultimate design load for the casting supporting the lowest load as follows:

Class A-1 — Castings in which the above ratio is less than 3.0.

Class A-2 — Castings in which the above ratio is between 3.0 and 10.0.

Class A-3 — Castings in which the above ratio is greater than 10.0

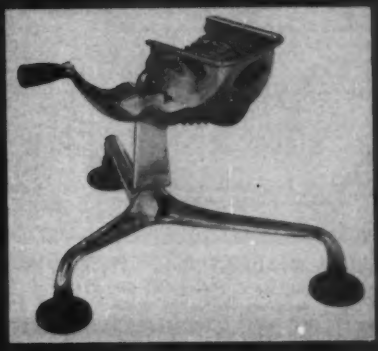
The static test and determined sub-classification of Class A castings will set-up final

continued next page

The LITEMETAL BULLETIN

PLATING ALUMINUM DIE CASTINGS REQUIRES SPECIAL TECHNIQUES

Close Co-Operation Between The Die Caster And Plater Is Essential To Successfully Give Aluminum Die Castings Fine, Smooth Finishes



Commercial plating of the light metals is relatively new. As in the zinc die casting industry, aluminum die casters have had to virtually re-learn their art in order to produce castings of sufficiently high quality to provide flawless plated surfaces.

Litemetal has proved itself capable of producing plating quality castings, for the Kitchen-Quip Saladmaster (illustrated), in large quantities. Working closely with one of the most successful platers of aluminum, Litemetal has developed the high quality standards and specialized techniques necessary to make plating of this die cast product practical.

Because of its lightness and lower cost, die cast aluminum was chosen for the body, handle and legs of the Saladmaster. Virtual elimination of machining and consequent labor savings effected, plus reduced shipping costs, made this choice most practical. The product's required appearance was attained with chromium plate. Production rates now approach 1,000 sets per day and will increase greatly as soon as plating facilities can be expanded.

Let's Talk It Over . . .

LITEMETAL DICAST, INC. is an organization of specialists — men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs — little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

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An understanding of the enormous possibilities of investment castings together with effective designing of metal parts make tremendous savings possible. Ask our representative to call and discuss your problem or send us drawings and specifications for complete engineering analysis and recommendations without obligation.

In any case send for this informative folder on Hitchiner Precision Investment Castings

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radiographic inspection requirements as follows:

Class A-1 — At least 25 percent of all production lots selected at random are subjected to X-ray inspection. If one percent of the inspected sample group fail to meet the established acceptance standards, the entire lot is radiographed.

Class A-2 — At least 10 percent of all production lots are radiographically inspected. Similarly, the entire lot is X-rayed if one percent of the 10 percent inspected is inferior to the acceptance standards.

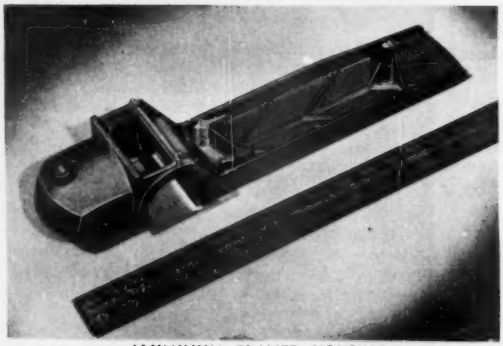
Class A-3 — Castings in this category shall be subject to visual inspection only.

Class B Castings

Class B castings are required to meet visual inspection requirements only. No static tests are required.

In addition to dimensional and radiographic or visual inspection, the following tests are made before final acceptance of a production lot of castings.

1. The steel investment castings must pass a 100 percent magnetic inspection.
2. The certified chemical analysis submitted by the contractor for each heat lot of specification.
3. Tensile bars submitted with each heat lot of castings are pulled to destruction to establish proof of mechanical properties.



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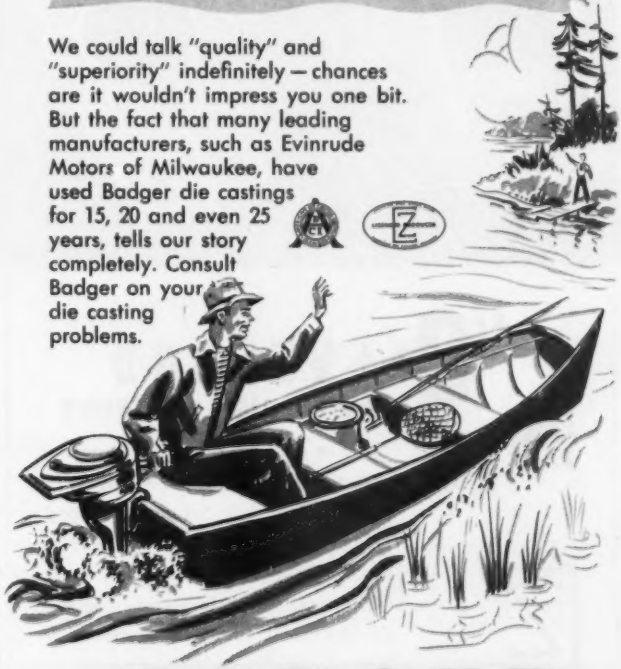

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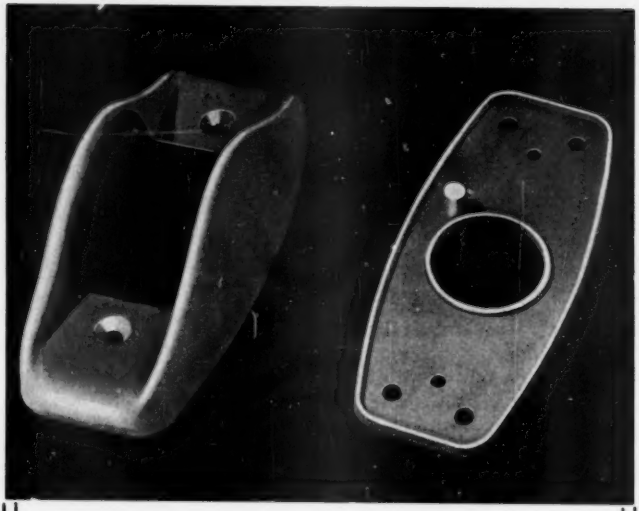

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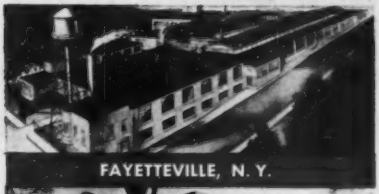

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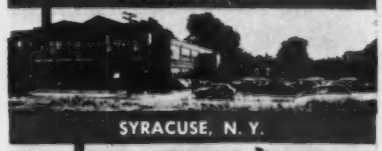

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